

# Introduction

The forestry degree program at Northern Arizona University was initiated in 1958 as a Department of Forestry dedicated to the training of professional foresters at the Bachelor of Science level. Its existence as a department and later as a professional School supported the recharter of Arizona State College to Northern Arizona University in 1966. In 1972, under the leadership of Dean Chuck O. Minor, an important and distinguishing change was made within the program. The faculty initiated resource integration in three intensive semesters – A, B, and C. In these three semesters, taken in the junior and senior years, students were taught the concepts of ecosystem management. A program in Native American Forestry was added in 1989, and the Park and Recreation Management major joined the School in 1992. A Master of Science degree was initiated in 1969 and Doctor of Philosophy in 1994. A separate and distinct Department of Geography and Planning joined the School in 1992, which led to the 1996 creation of a College of Ecosystem Science and Management.

## **Standard I: Forestry Program Mission, Goals and Objectives**

Two different processes created the School of Forestry's current mission, goals and objectives. The first was the development of the *School's Strategic Plan: A Working Document for 1996-2001*, which received faculty approval in 1996 following many hours of effort and the careful thought by the Strategic Planning Group. The second process was the formation of the Professional Curriculum Review Committee in February 1998. This led to a report entitled: *Report of the Professional Curriculum Review Committee to the School of Forestry Faculty – Maintaining Leadership in Innovative Forestry Education*. The School's mission statement is as follow:

*The fundamental educational mission of the School Forestry is to foster the intellectual and personal development of our students, at both the undergraduate and graduate levels. We intend that our students be, first of all, liberally educated, secondly, good citizens, and finally, skilled professionals.*

*The School of Forestry educates students in ecosystem science and management by integrating instruction in biophysical and human systems. In Forestry, we cross traditional boundaries by applying a transdisciplinary approach and multiple resource knowledge to ecosystem studies.*

*Our scholarship mission features these integrative approaches to advance knowledge in ecosystem science and management and to bring this new knowledge back to the classroom. Our Master of Science in Forestry and Doctor of Philosophy programs play a special role in carrying out our scholarship objectives.*

*Our mission includes the development of educational and research activities, which bring Native American views to the classroom.*

The School of Forestry's current objectives as originally presented in the *Strategic Plan: A Working Document for 1996-2000* are as follows:

- To be the leading undergraduate forestry education school in North America by maintaining our unique integrated undergraduate curriculum.
- To maintain our status as the leading educational/research academic institution for Native American forestry.
- To have our Parks and Recreation program attain a national reputation based on its focus on the human: nature interaction.
- To significantly increase the number of students applying for the Forestry degree program.

- To increase the School's role in across campus activities. This goal involves:

teaching more non-forestry undergraduates.

maintaining an active role in other graduate programs.

establishing an Environmental Management emphasis  
within the Environmental Science Program.

- To continue to strengthen the School's graduate programs by:

Strengthening the Ph.D. forest management and economics emphasis area.

Implementing a new Master of Science graduate degree.

- To establish a University Forest for the purpose of education and research.
- Become a repository of knowledge of ecosystem science and management for the Colorado Plateau.

- To produce graduates with high competence in both oral and written communication skills.

**The University's mission is as follows:**

Northern Arizona University is a doctoral-intensive institution that has at its core, undergraduate programs (our emphasis), significant research, and graduate programs to the doctoral level appropriate to its size and classification. Northern Arizona University aspires to be a premiere undergraduate residential institution that provides its students with an innovative and challenging liberal arts and sciences core integrated with a comprehensive number of professional programs. The learning environment at the Mountain Campus is unmatched for natural beauty and for student-centered programs and services. Undergraduate programming prepares students for life in the twenty-first century by assuring individual development through small classes, close interaction with senior faculty, and sophisticated learning technologies more commonly found at the nation's leading private universities.

Northern Arizona University also provides exceptional quality in a selected number of post-baccalaureate certificates, master's and doctoral programs in its areas of greatest strength. The University seeks to expand its post-baccalaureate programs as interdisciplinary fields expand and as the needs of economy demand increasing levels of educational preparation. Intimately linked to its undergraduate and graduate missions, the University's faculty, organized in departments, research centers and institutes, advances knowledge in traditional disciplines, in fields related to NAU's unique environment on the Colorado plateau, and in response to the needs of the state and region for solutions to real world problems.

Finally, NAU is an integral part of the northern Arizona and Flagstaff communities. It embraces its mission to serve rural Arizona, Native American peoples, and seeks a partnership in providing economic, cultural, and social opportunities for all citizens of the region. Consonant with its mission to serve the state's rural counties, the university has

innovative partnerships with rural community colleges, operates an education center in Yuma and IITV sites in twenty-six locations plus technology-based delivery into offices and homes.

**NAU's goals are:**

- To be a premiere undergraduate residential learning community emphasizing superior undergraduate programs.
- To be recognized regionally, nationally and internationally for selected creative endeavors, research and graduate programs especially those that build from our base on the Colorado Plateau.
- To provide regional and national leadership in the development, use and assessment of technologies to enhance and deliver superior educational programs.
- To foster a culture of diversity visible in academic programming and in the recruitment of faculty, staff and students.
- To be the nation's leading non-tribal university in affording educational opportunities for Native American students, in providing service and applied research to Native American tribes, and in advancing research concerning the history, culture and contemporary issues of Native American people.
- To increase private support and research funding to supplement state funding and tuition, in order to guarantee an operating budget that supports academic excellence.

Three other documents pertain to the future direction of Northern Arizona University under its new President, John D. Haeger. These are: *Northern Arizona University's 2003 Strategic Plan*, *Achieving Excellence Northern Arizona The Next Five Years*, and

*Changing Directions Northern Arizona University Concept Paper.* All can be found on the web site for the Office of the President – <http://www4.nau.edu/president/>.

### **A. The Professional Forestry Program**

The underlying educational philosophy of the Professional Forestry Program focuses on the integrated instruction of students in ecosystem science and management. This currently includes a team-taught immersion approach taught in two 13-credit courses across two semesters in the junior year and two 6-credit courses, one in each semester of the senior year.

The recent changes made in the forestry professional program described below reflect our desire to maintain our integrated approach to teaching, which we believe is recognized nationally as a significant and unique strength of our forestry program, as well as now allowing students to explore an emphasis area. The addition of an emphasis area to the professional program allows students to expand their knowledge of ecosystem management in a particular area (e.g. international forestry, forest health, or ecological restoration). Three changes are based on recommendations made by students, alumni, forestry professionals, and a comparison with our peer forestry institutions.

In developing the most recent program requirements, the faculty reviewed a number of published articles and reports on the desired characteristics of forestry graduates. The general consensus was that a competency-based approach to describing the desirable characteristics of the NAU graduate was appropriate. We use the term “transferable skills” to include things like writing, oral communication, leadership, decision-making, working in groups, etc. In addition, a desirable NAU graduate would have subject competencies in areas like wildlife, ecology, silviculture, pest management, economics and multi-subject competencies such as valuation, integrated resource planning (developing alternatives), conflict resolution, etc. We believe this approach is very

consistent with ideas presented by Sample et al. 1999<sup>1</sup> and with the changing philosophy of the Society of American Foresters accreditation standards.

The faculty spent considerable time debating which of the above transferable skills and subject matter competencies were adequately included in the curriculum. Needless to say, we did not achieve consensus on all areas discussed. However, the following five areas were generally agreed upon as important competencies that we needed to specifically identify and perhaps enhance in our program:

1. Working in teams particularly with a focus on how to formally structure and manage a resource analysis or management team.
2. Public presentation experience (speaking across the curriculum) perhaps in the format of writing across the curriculum to improve confidence in students to speak before public and professional groups.
3. Dispute resolution and negotiating skills
4. Business and organizational management skills in leadership, financial management, and organizational development. This was an area for perhaps some enhancement but with the recognition that these skills are often developed “on-the-job.”
5. Recognition of personal vs. professional ethics. How do ethical beliefs develop and how do we balance personal ethics with professional activities?

The professional forestry courses have been designed to build on knowledge and skills acquired in the pre-professional program, including forestry and non-forestry pre-requisite courses. The transition from the pre-professional to the professional program is

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<sup>1</sup> Sample, V. Alaric, Paul C. Ringold, Nadine E. Block, and James W. Giltmier. 1999. Forestry education: Adapting to the changing demands of the profession. *Journal of Forestry*. 97(9):4-11.

facilitated by faculty introducing transferable skills such as writing, working in groups, use of technology, ethics, and professionalism early in the pre-professional forestry curriculum and continuing to strengthen those skills in the professional program.

Finally, we believe it is important to clarify terms that we commonly use to describe our unique teaching format. The following terms are thus defined as:

**Team teaching:** The simultaneous participation of multiple faculty members within an instructional unit. Team teaching requires that all faculty members present actually participate either through shared lectures or discussion.

**Sequential teaching:** (synonym: tag team teaching): multiple faculty members teaching independent sections. Faculty members may coordinate their presentations but the format is a single faculty member presenting their material without the presence or participation of other faculty.

**Integrated teaching:** A deliberate effort on the part of faculty to relate their educational material with that presented by another faculty member. Integrated teaching is multidisciplinary and requires faculty to present material from a variety of perspectives and to link material to ideas taught previously in the course. A single discipline approach that does not recognize well established opposing perspectives would not be considered “integrated.”

**Immersion teaching:** Immersion teaching is a format in which students are exclusively taught a single topic. This term is often used to describe language training. A forestry immersion course would be one which students enroll in forestry courses only. The traditional FOR 313 – Semester A model would be considered a typical immersion teaching format. Immersion teaching does not necessarily result in integrated teaching and may or may not be team taught.



We believe that the Forestry Program's educational goals are reasonably well presented in the NAU General Catalog, our program flyer (Appendix A), but most importantly on our web site (Appendix B). The NAU General Catalog is in the materials accompanying the Self Evaluation Report.

## **Standard II Curriculum**

The School of Forestry offers only one undergraduate degree in Forestry and that is a Bachelor of Science in Forestry (extended major).

### ***A: Introduction***

Before reviewing the Forestry curriculum in some detail we would like to provide some general information about the Forestry major which has two parts:

- a. The pre-professional preparatory first two years or lower division requirement consisting of 60 semester credits
- b. The upper division Core Professional Forestry final two years consisting of:
  - a. 38 credits of the professional Forestry Core
  - b. A 12-credit Forestry Emphasis area
  - c. A 3-credit upper division Political Science co requisite requirement
  - d. 10 credits of free electives

Students apply for the Professional Forestry Program normally in the Spring Semester of their sophomore year and must meet certain requirements (Appendix C):

- a. Admission is limited to 40 students in each cohort and requires completion of all lower-division required courses, with the exception of FOR 220, which may be taken concurrently with FOR 313-316.

- b. Students must have an overall grade point average of 2.5 or greater in all the pre-professional courses (excluding non-prerequisite liberal studies and elective course).
- c. Have earned a grade of C or better in FOR 101, 211, 212, 213, and 220 (or equivalent courses approved by the School of Forestry).

The degree requirements for the Bachelor of Science in Forestry are listed in Figure 1.

### ***B: General Education Requirements***

NAU requires that all students irrespective of major fulfill a 35-credit Lower Division Liberal Studies requirement. This requirement has the following seven area requirements (bold face) with the minimum credit requirement in each area given in parentheses. The School of Forestry is fortunate in that we are permitted to simultaneously use our lower-division Forestry requirements (to double count) in fulfilling the University Liberal Studies requirements. The courses the School uses are shown within each area. This is perhaps more easily seen and understood on the Degree Requirements (Figure 1)

Figure 1

# SCHOOL OF FORESTRY NORTHERN ARIZONA UNIVERSITY

## Degree requirements for Bachelor of Science in Forestry

Name: \_\_\_\_\_

ID: \_\_\_\_\_

**Liberal Studies (35 credits total)**

<sup>c</sup> See reverse for suggested Liberal Studies courses

**Foundations (7)**

- 1a. ENG 105 *or* 4<sup>a</sup> *or*
- 1b. ENG 101/102 6<sup>a</sup>
- 2. MAT 125 4<sup>a</sup>

**ELECTIVES (7 credits):** \_\_\_\_\_

**University Colloquium (3)**<sup>b</sup>

**Lab Science (4)**

CHM 130 & CHM 151L 5<sup>a</sup>

**Science/Applied Science (3-6)**

CIS 120 w/lab 3  
STA 270 3

**Social and Political Worlds (3-6)**

ECO 284 3  
COM 111 3

**Aesthetic and Human Inquiry (3-6)**<sup>c</sup>

\_\_\_\_\_  
\_\_\_\_\_

**Cultural Understanding (3-6)**<sup>c</sup>

\_\_\_\_\_  
\_\_\_\_\_

total liberal studies completed 23<sup>b</sup>  
liberal studies left to complete 12

**Lower Division (48)**

	credits	grade	transfer equivalent
ENG 105 <i>or</i>	(4)		
ENG 101/102	(6)	_____	_____
MAT 125	(4)	_____	_____
ENG 205	(2)	_____	_____
STA 270	(3)	_____	_____
BIO 181 w/lab	(4)	_____	_____
BIO 182 w/lab	(4)	_____	_____
CHM 130	(4)	_____	_____
CHM 151L	(1)	_____	_____
CIS 120	(2)	_____	_____
CIS 120L	(1)	_____	_____
COM 111	(3)	_____	_____
ECO 284	(3)	_____	_____
FOR 101	(3)	_____	_____
FOR 211	(3)	_____	_____
FOR 212	(2)	_____	_____
FOR 213	(3)	_____	_____
FOR 220	(2)	_____	_____

Total: (48)

**Upper Division Core Professional Forestry Program (38) (grades)**

FOR 313/314/315/316	(13)	____/____/____/____
FOR 323/324/325/326	(13)	____/____/____/____
FOR 413/414	(6)	____/____
FOR 423/424	(6)	____/____

Total: (38)

**Upper Division Forestry Corequisite Requirement (3) (grades)**

Choose one course from the following:

POL 344\_\_\_\_\_ POL 359\_\_\_\_\_

<sup>a</sup> Only maximum credit in the distribution block allowed  
<sup>b</sup> See reverse for more info on University Colloquium  
**EMPHASIS AREA (12 credits)**

\_\_\_\_\_  
\_\_\_\_\_

\_\_\_\_\_

**Figure 1 Continued.**

NOTE -- By completing the liberal studies requirements (35 credits) and the major requirements (101 credits, including emphasis and co requisite courses), the student will still need to complete *at least 7* credits of electives to graduate depending on the student's situation.

**University Colloquium**

The University Colloquium is required for all new first-time and transfer students with 11 or fewer transferable credits as determined by the Registrar's Office. A transfer student having 12 or more transferable credit hours does not need to take the University Colloquium. Instead, the student can meet the requirement by completing *any* approved Liberal Studies course.

**Suggested Liberal Studies courses**

While we do not require specific courses in the Aesthetic and Human Inquiry or Cultural Understanding blocks, we do offer suggestions that relate to the profession.

**Aesthetic and Human Inquiry (3-6):**

COM 250	3 credits	Environmental Perspectives on Communication Arts
ENG 210	3 credits	Principles of Rhetoric
ENG 211	3 credits	Principles of Written Argumentation
PHI 331	3 credits	Environmental Ethics

**Cultural Understanding (3-6):**

ANT 102	3 credits	Studying Cultures
ANT 103	3 credits	Culture and Communication
ANT 205	3 credits	Native Peoples of North America
HUM 175	3 credits	Environmental Humanities
HUM 373	3 credits	Nature and Values
REL 391	3 credits	Religion, Nature and the Environment

**Further explanation on Liberal Studies:**

By completing the required lower division courses for the Forestry program, the student will also have completed 23 of the 35 required credits in the Liberal Studies program. Keep in mind though, a student may have more credits in a distribution block than can be counted towards Liberal Studies. For instance, a student who completes ENG 105 and MAT 125 can only count 7 credits towards the Foundations distribution block under Liberal Studies even though the courses together add up to 8 credits. So, a student who completes the Forestry major lower division courses will have completed 7 credits in Foundations, 4 credits in a Lab Science, 6 credits in Science/Applied Science, and 6 credits in Social and Political Worlds. A forestry student will still have to complete 12 credits of Liberal Studies distributed amongst Aesthetic and Human Inquiry, Cultural Understanding, and the University Colloquium (see above for more information on the University Colloquium). Each student must complete at least six credit hours in EITHER the Aesthetic and Human Inquiry OR the Cultural Understanding block to satisfy Liberal Studies requirements of completing at least six credit hours in three of the four distribution blocks that require 3-6 credit hours.

**Revised 1/2001**

**Foundations (7)**

1a. ENG 105 – Critical Reading and Writing in the University Community	4
or	
1b. ENG 101 and 102 (one year of freshman English)	6
2. MAT 125 – Precalculus Mathematics	4

**University Colloquium (3)**

UC 101 – University Colloquium	3
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**Laboratory Science (4)**

CHM 130 – Fundamental Chemistry	4
CHM 151L – General Chemistry Laboratory	1

**Science/Applied Science (3-6)**

CIS 120 with lab – Intro. to Computer Information Systems	3
STA 270 – Applied Statistics	3

**Social and Political Worlds (3-6)**

ECO 284 – Principles of Economics: Micro	3
SC 111 - Fundamentals of Public Speaking	3

**Aesthetic and Human Inquiry (3-6)**

Elective	3
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## **Cultural Understanding (3-6)**

Elective

3

Using the Society of American Foresters' format The General Education Requirements for the Forestry major are summarized in Document A (General Education Summary).

Total credit hours requirements in the four areas are:

Communication – 6

Science and Mathematics – 15

Social Science and Humanities – 6

Electives – 13

This 40-credit General Education Requirement does not include the following:

Free electives – 7

University Colloquium – 3

Aesthetic and Human Inquiry elective – 3

Cultural Understanding elective – 3

## GENERAL EDUCATION SUMMARY (DOCUMENT A)

Institution Name: Northern Arizona University

Academic Year: 2002/2003

Official Curriculum Title: Bachelor of Science in Forestry

Official Option Title: Forestry (extended major)

Required Courses:	Total Credit Hours			
Course # & Title	Communications	Science & Mathematics	Social Science & Humanities	Electives
ENG 105 Critical Reading and Writing in the University Community	4			
ENG 101 & 102	6			
ENG 205 The Academic Writer's Workshop	2			
MAT 125 Precalculus Mathematics		4		
UC 101 University Colloquium				(3)*
CHM 130 Fundamental Chemistry		4		
CHM 151L General Chemistry Lab		1		
Total Credit Hours				

## GENERAL EDUCATION SUMMARY (DOCUMENT A)

(Continued)

Institution Name: Northern Arizona University

Academic Year: 2002/2003

Official Curriculum Title: Bachelor of Science in Forestry

Official Option Title: Forestry (extended major)

Required Courses:  Course # & Title	Total Credit Hours			
	Communications	Science & Mathematics	Social Science & Humanities	Electives
CIS 120 w/Lab Intro to Computer Information Systems		3		
STA 270 Applied Statistics		3		
ECO 284 Principles of Economics			3	
SC111 Fundamentals of Public Speaking			3	
Electives				7
Aesthetic & Human Inquiry				3
Cultural Understanding				3
<b>Total Credit Hours</b>	<b>6</b>	<b>15</b>	<b>6</b>	<b>13</b>

<sup>1</sup>List restricted electives, if any, and include total elective credit hour for curriculum

\*Not included in total



## **C: The Professional Forestry Program**

### **1) Introduction and Goals of the Professional Program**

The underlying educational philosophy of the Forestry Professional Program focuses on the integrated instruction of students in ecosystem science and management. This currently includes a team-taught immersion approach taught in two block courses across two semesters and a yearlong senior capstone course of 12 credits.

A comparison of NAU's curriculum to the Pinchot Institute Study reported in the Journal of Forestry (Sample et al. 1999) revealed there were topics, which should increase, and topics, which should decrease in time allocated in our program. Topics that were considered for enhancement based on that report includes working in teams (add formal training), oral presentations (more experience in FOR 313), dispute resolution, business management (including managerial leadership, financial management, organizational development) and ethics. Topics that could be decreased in time allocated included range, wildlife, ecology, silvics, planning management and field skills. In an effort to balance the Pinchot Institute Study with SAF accreditation objectives of providing an "in-depth coverage with a global perspective of forest ecology and biology, measurement, management, and policy and administration", the content and structure of the upper division professional program was modified as described below. In addition, changes made in the content and structure of the Professional Program also reflect a comparison with 14 other peer forestry programs around the country.

The upper division core professional program now includes four courses:

FOR 313-316	Forest Ecology and Silviculture	– 13 credits
FOR 323-326	Forest Management	– 13 credits
FOR 413,414	Forest Assessment	– 6 credits
FOR 415,416	Forest Planning	– 6 credits

FOR 313-316 is taken in the Fall Semester and focuses on forest ecology and silviculture. FOR 323-326 is taken in the Spring Semester and addresses human dimensions of ecosystem management, specifically managing forest resources to meet multiple goals. The capstone forestry courses, FOR 413, 414 and 415, 416, are taken over two semesters and enable students to apply knowledge and concepts acquired throughout their pre-professional and professional program courses and apply them toward conducting an ecosystem assessment and developing a management plan for a resource area.

The implications of the changes in the professional program are discussed in the sections that follow. These implications include improving the integration and flow within and among professional program courses, structural changes in the professional program, and how the new curriculum compares with other forestry programs. The desired competencies, learning activities, and assessment methods for each of the four professional program courses are provided in the last section. A general breakdown of credit hours in SAF related areas of study are given in Document B.

## FOREST RESOURCES EDUCATION SUMMARY (DOCUMENT B)

Institution Name: Northern Arizona University

Academic Year: 2002/2003

Official Curriculum Title: **Bachelor of Science in Forestry**

Official Option Title: **Forestry (extended major)**

Required Courses: # & Title	Credit Hours in SAF-Required Areas of Study				Total Credit Hours
	Forest Ecology & Biology	Measurement of Forest Resources	Management of Forest Resources	Forest Resources Pol. & Admin.	
*FOR101 Intro. to Forestry	N/A	N/A	N/A	N/A	
FOR 211 Forest Measure		3.0			3.0
FOR 212 Trees and Forests of North America	2.0				2.0
FOR 213 Ecology & Mange of Forest Soils	3.0				3.0
FOR 220 Intro to Forest and Range Plants	2.0				2.0
FOR 313 Forest Ecology I	7.5 (forest ecology)		5.5		13.0
FOR 314 Forest Ecology II	↓		↓		↓
FOR 315 Silviculture Principals					
FOR 316 Silviculture Applications	↓				↓
Total Credit Hours	—	—	—	—	—

## FOREST RESOURCES EDUCATION SUMMARY (DOCUMENT B)

(Continued)

Institution Name: Northern Arizona University

Academic Year: 2002/2003

Official Curriculum Title: Bachelor of Science in Forestry

Official Option Title: Forestry (extended major)

Required Courses: # & Title	Credit Hours in SAF-Required Areas of Study				Total Credit Hours
	Forest Ecology & Biology	Measurement of Forest Resources	Management of Forest Resources	Forest Resources Pol. & Admin.	
FOR 323W Forest Management I		1.0 Biometrics	7.0	5.0	13.0
FOR 324 W Forest Management II		↓	↓	↓	↓
FOR 325W Forest Management III		↓	↓	↓	↓
FOR 326 Forest Management IV		↓	↓	↓	↓
FOR 413C Resource Assessment I		4.3	5.6	2.1	12.0
FOR 414 C Resource Assessment II		↓	↓	↓	↓
FOR 423C Forest Ecosystem Planning I		↓	↓	↓	↓
FOR 424 C Forest Ecosystem Assessment II		↓	↓	↓	↓
Total Credit Hours	—	—	—	—	—

## FOREST RESOURCES EDUCATION SUMMARY (DOCUMENT B)

(Continued)

Institution Name: Northern Arizona University

Academic Year: 2002/2003

Official Curriculum Title: Bachelor of Science in Forestry

Official Option Title: Forestry (extended major)

Required Courses: # & Title	Credit Hours in SAF-Required Areas of Study				Total Credit Hours
	Forest Ecology & Biology	Measurement of Forest Resources	Management of Forest Resources	Forest Resources Pol. & Admin.	
Emphasis Area					**12.0
Electives					**7.0
POS 344 Environmental Movements					**3.0
Or					or
POS 359 Environmental Policy					**3.0
	<p>*FOR 101 is not included since this requirement is often fulfilled by non-forestry introductory environmental courses. FOR 101 is a general survey of all aspects of forestry. It focuses on recruiting and retaining students.</p> <p>**Not included in Total Credit Hours.</p>				
Total Credit Hours	14.5	8.3	18.1	7.1	48.0

## **2) Improving Integration and Flow**

### **a) Flow and Transition Across the Forestry Curriculum**

As described earlier, the changes in the professional program reflect a renewed commitment to the goal of integration and flow across the professional program courses. The professional program courses were designed to build upon and complement one another, culminating in a capstone experience. The capstone courses, FOR 413, 414 and 423, 424 require the integration of materials learned in FOR 313-316, Forest Ecology and Silviculture, and FOR 323-326, Forest Ecosystem Management, as well as skills learned in Liberal Studies and Forestry emphasis area courses. The primary instructional technique used in FOR 413, 414 and 423, 424 is learning by doing whereby students must integrate knowledge gained previously in order to accomplish the tasks needed to complete the course. Infrequent formal lectures provide direction and help in getting started, but more often faculty serve as consultants working with students individually or in small groups to answer questions and to discuss approaches to problems. Students are often required to work independently in inventory design, data collection, and data analysis. The process followed by students is similar to that followed by real world forest managers and planning analysts in ecosystem assessment. In this process, students are expected to apply their knowledge of ecological and management principles, professional judgment, and logical thought to derive sound and creative solutions to typical forest inventory problems and forest change projection, while working within time constraints. Faculty are available, upon request, to provide advice like that which would be provided by supervisors and resource specialists.

In addition to supporting FOR 413, 414 and 423, 424 as the capstone, integrative experience for forestry students, we offer the following to facilitate and encourage a smooth and logical transition and flow among the professional program courses:

- Faculty teaching in the professional program are encouraged to be familiar with the content of the professional courses to avoid unnecessary redundancy and overlap.

- Coordinators of the professional program courses are encouraged to continue to provide binders in the faculty lounge with syllabi and other relevant materials from professional program courses for faculty to peruse.
- A case study, discussion questions (e.g., “what is ecosystem management and what do you need to know to do it?”), or similar exercises is introduced in FOR 313-316 and re-introduced and revisited and expanded upon in FOR 323-326 and carried on into FOR 423, 414 and FOR 415, 416.
- The Centennial Forest is used as the common resource base for the three professional program courses.
- Faculty from FOR 323-326 should be introduced at the end of FOR 313-326 and FOR 413, 414 faculty introduced at the end of FOR 323-326.

#### **b) Flow and Integration Within the Professional Forestry Courses**

In addition to improving integration among the professional program courses, the changes in the professional program were designed to improve integration and flow within the individual courses themselves. We reaffirm the School of Forestry’s commitment to integrated teaching within the professional program courses wherein there are not stand-alone sections but truly integrated discussions and activities. Changes in the program and suggestions for improving flow and integration in the professional program include:

- One of the most significant changes proposed for FOR 323-326 was the addition of spatial structure as an orienting focus for talking about multiple subjects relevant to that particular structure. A similar hierarchical scaling structure is used in FOR 313-316, which helps in the transition between FOR 313-326 and FOR 323-326.

- FOR 323-326 lab times were restructured to provide the opportunity for an all-day integrated lecture/discussion/lab period.
- Coordinators of all four professional semesters are encouraged to hold regularly scheduled meetings of involved faculty to facilitate integration and collaboration and avoid undue repetition and overlap.
- Faculty teaching in the professional program need to be committed to an integrative and collaborative, approach to higher education.

#### ***D: Changes in Curriculum Content***

##### **1) Pre-professional**

###### **a) Goals and competencies**

The pre-professional sequence of courses has five fundamental goals:

- Prepare students specifically for the Professional Forestry Program; development content knowledge (terminology, concepts and issues) and skills necessary for success in our program.
- Provide consistent outstanding academic experiences for recruitment and retention during our students' first years, including preparation for and access to summer employment.
- Educate liberally and broadly, making constant connections to forestry in general and/or an emphasis area (e.g., why math and chemistry are important).
- Provide opportunities for persons to access the University's Forestry courses through distributed (distance) learning system, with implications for recruitment and retention.
- Increase class enrollment and number of majors.



Table 1 further defines the first goal, developing competencies in our students, using desired outcomes, activities, and assessments for the 5 lower-division forestry courses that we require of all students.

<b>Table 1</b>	Activity	Assessment
<b>FOR101 Introduction to Forestry</b> Understanding of the forestry profession: terminology, concepts, and current topics - broad and engaging. Excitement about our profession. Introduction to our curriculum and potential emphasis areas. <b>3 credits</b>	***flexible*** Readings Lectures Discussion groups Field trips Writing assignments Professional development	Exams and/or quizzes Writing evaluation – may include some computations Participation grades
<b>FOR211 Forest Ecosystem Meas.</b> Natural resources sampling and inventory knowledge and skills. In-office data analysis, summary and interpretation. <b>3 credits</b>	Readings Lectures Field labs Weekly lab write-ups	Exams Lab evaluations
<b>FOR213 Forest Soils.</b> Basic geology, geomorphology and soil taxonomy Soil physical, chemical and biological properties <b>3 credits</b>	Readings Lectures Outdoor labs Report writing	Exams and quizzes Report evaluation
<b>FOR212 Trees and Forests of N. A.</b> Tree taxonomy and silvics Forest types <b>2 credits</b>	Readings Lectures Information searches Report writing	Exams and quizzes Report evaluation
<b>FOR220 Forest and Range Plants</b> Field plant identification Taxonomy Basic autecology <b>2 credits</b>	Field trips Field lectures	Frequent quizzes

Note the addition of **FOR213 Forest Soils** to the pre-professional program; the rationale for this is discussed below. Note also that FOR220, an existing parallel class to Semester A, Taxonomy, was placed in the pre-professional program and its content removed from 313. This structural change was done to provide a fun, outdoor experience to students

who are “thinking about” forestry or who are early in their major. It is a good companion to FOR101.

### **b) Transfer Student Implications**

The pre-professional sequence of forestry courses (FOR101-211-212-213-220) is required for students who enter NAU as a freshman but more flexibility is allowed for transfer students. Requirements for transfer students are based on the similarity of their previous coursework and employment to our pre-professional competencies:

FOR101 and FOR212 are most easily substituted for (i.e., these might not be required courses to be made up by transfer students prior to admission into FOR 313-326 if students are otherwise ready to enroll). These courses are excellent choices to make available via distributed learning to minimize these issues and to aid in recruitment.

FOR211 is strictly evaluated for replacement only by a “Forest Measurements” class (i.e., “Plane Surveying” will no longer suffice); however, Summer Session availability eases scheduling problems for most transfers.

FOR213 is also strictly evaluated for replacement only by another Forest or agricultural soils class; otherwise, it must be taken here the Spring semester before FOR 313-326.

FOR220 must be taken here prior to or concurrent with FOR 313-326.

### **c) Comparison to other schools**

A comparison with other SAF-accredited forestry programs in the United States led to the following two changes to the content of our pre-professional program.

1. Few programs require geology but most have a more substantial soils component. We therefore dropped the 4-credit GLG 101/103 requirement (which has little soils) and created a separate Forest Soils course, since there was not room for a substantial increase in soils within Semester A. This new 3-credit FOR 213 course, with 2 lectures and a lab each week, covers the basics of geology as it relates to soil geomorphology and properties, and also focuses on the relevance of soils to forestry.
  
2. Few programs require macroeconomics. We therefore dropped the 3-credit ECO285 requirement to create more room for Emphasis Area courses and/or electives.

**d) Relationship with the Emphasis Areas**

Reducing and altering the content of the pre-professional program was influenced by the addition of Emphasis Areas, in addition to the competency needs of the professional program and a comparison with other schools. Reducing the credit hours of the pre-professional program allows freshman and sophomores to begin to explore potential emphasis areas. We believe the changes still provide the needed breadth of exposure, a breadth that will complement the focus of an Emphasis Area.

**e) Summary**

In summary, the structural and content changes in the pre-professional program were as follows:

<b>1991/1992 Forestry Major:</b>		<b>2002/2003 Forestry Major with emphasis areas:</b>	
Liberal Studies	35	Liberal Studies	35
“Net” additional pre-professional with FOR101/211/212 with GLG and ECO285	27	Net additional pre-prof. with FOR101/211/212/ 213/220 no GLG or ECO285	25
Prof. upper-division core	48	Prof. upper-division core	38
Electives	10	Emphasis Areas	12
	120	Electives	7
		Upper-Division Co-requisite in Political Science	3
			120

## ***E. Professional Program Curriculum***

### **1) FOR 313-316: Forest Ecology and Silviculture**

#### **a) Course Objectives**

The goal of FOR 313-316 is to provide students with up-to-date knowledge of silviculture and forest ecology. Course topics for ecology include autecology, communities, wildlife, entomology/pathology, disturbance/recovery, and ecosystem processes and classification. The ecology section is organized progressively across the semester from the individual tree and its relation to its environment at the beginning of the semester, scaling up to the community level during mid-semester and finally to the ecosystem spatial scale in the last one-third of the semester. Where possible, silvicultural and ecological concepts are linked throughout the semester. An explicit transition from FOR 313-316 to FOR 323-326 has been created in the form of an ecosystem-level project that gets started at the end of FOR 313-316 and concludes in the beginning of FOR 323-326.

In addition to teaching forest science, the faculty of FOR 313-316 are committed to teaching and facilitating student development in transferable knowledge, skills and abilities in quantitative skills, field measurements, forest sampling, technical writing, computer skills and career development skills. One or more of these transferable skills are emphasized in the teaching of each unit.

#### **b) Changes to FOR 313-316**

FOR 313-316 was reduced from the previous 16 semester hours to 13 semester hours. The 13 hours consists of 10 credit hours of lecture and 3 credit hours of laboratory compared to 12 credits of lecture and 4 credits of laboratory under the 16-credit structure.

The reduction in credit hours was accomplished by implementing the following changes:

- The taxonomy lab was removed and became a separate course (FOR 220). Students transferring without this course can take it concurrently with Semester A.
- The soils component of FOR 313-316 was removed and established as a separate course (FOR 213) while geology was dropped as a prerequisite course.
- The Monday all-day "integrative" lab was reduced from 9:10-4:30 to 10:20-4:20. (This is equivalent to 2 – 3 hour lab periods)
- Classes on Wednesday and Friday were reduced from two 75-minute sessions to two 50-minute sessions and they met from 10:20-11:10 and 11:30-12:20. The Tuesday/Thursday classes remains unchanged and meets from 9:35-10:50 and 11:10-12:25.
- Silviculture represents 5.5 of the 13 credits in FOR 313-316 compared to the current 6 credits. It meets for lecture on T/Th 11:10-12:25 and Fridays 11:30-12:20 for a total of 4 credits of lecture. Silviculture lab was moved from Thursday, 1:30-4:30 to Wednesdays 12:50-3:50 for a total 1 credit of lab plus 0.5 credits of additional lab time on Mondays.
- Ecology represents 7.5 credits of the 13 credits in FOR 313-316 compared to the former 10 credits. It meets for lecture on T/Th 9:35-10:50, Wednesdays 10:20-11:10 and 11:30-12:20 and on Friday 10:20-11:10 for a total of 6 credits of lecture. Ecology also has 1.5 credits of lab on Mondays.
- A section on career development was added. Lecture and lab hours for this section are credited equally to ecology and silviculture (approximately three 50-minute classes plus one 3-hour lab).

- A section on wood product resources was added to the ecology portion of the course.

The following summarizes the changes in subject areas and credits hours between the current FOR 313-316 and proposed.

<b>Subject</b>	<b>Topic</b>	<b>1991/1992 Credits</b>	<b>2002/2003 Credits</b>
Ecology	Adaptation	0.9	0.8
	Soils	1.2	0.0
	Wildlife Ecology	1.1	1.0
	Entomology/Pathology	1.3	1.2
	Community Ecology	1.0	0.9
	Disturbance/Recovery	1.4	1.3
	Ecosystem Processes	1.4	1.3
	Ecosystem Classification	0.7	0.6
Silviculture	Wood Products	0.0	0.4
		6.0	5.5
Plant Taxonomy		1.0	0.0
<b>Total</b>		<b>16.0</b>	<b>13.0</b>

## 2) FOR 323-326: Forest Ecosystem Management

### a) Course Objectives

The goal of FOR 323-326 is to provide students with up-to-date knowledge for managing forestland resources in a social context. We examine the techniques for producing wood, water, and livestock commodities, and recreation and wildlife amenities. The specific topics of this course include sustainable, integrated ecosystem management, recreation management, biometrics, timber management, wildlife habitat management, policy, forest operations, and range management. Our primary purpose is to help students grasp the integrated nature of forest management; not only are the production activities noted above components of an interrelated ecological system, they are parts of a complex social system as well. Thus, an underlying, but unifying theme for the semester is decision-making based on economic and political realities. Students learn not only how to

produce commodities and amenities from our forestlands, but also are exposed to ideas concerning how much, for whom, and why.

We added a spatial component to FOR 323-326 wherein subject areas are examined from stand, forest, and landscape levels. This provides an integrating perspective from which to study the complex multi-resource decisions that must be made in managing forest resources for multiple outputs and understanding the trade-offs that are often necessary to meet multiple goals.

In addition to teaching forest ecosystem management, the faculty of FOR 323-326 are committed to teaching and facilitating student development of integrating skills and abilities. These transferable skills and abilities, which include writing, leadership, oral communication, decision making, GIS/ITAC (Information Technology Across the Curriculum), and working in groups, are crucial to the development of forestry professionals and are developed across the professional program curriculum, including FOR 323-326.

### **b) Changes**

The former course, FOR 312, was reduced from the current 16 semester hours to 13 semester hours. Previously, this unit was divided into four courses with the following topics and associated credits:

	<b>Subject Area</b>	<b>Credit Hours</b>
323:	Week 1 Introduction	1.1
	Stand-Level Timber Management	1.9
	Final Integrated Case Study	1.1
324:	Biometrics	1.0
	Forest-Level Management	3.2
325:	Forest Operations	2.2
	Habitat Management	2.3
326:	Policy	1.5
	Recreation Management	1.7
<b>Total</b>		<b>16.0</b>

The 13-credit structure for FOR 323-326 now consists of the following breakdown:

<b>Subject Area (based on SAF categories)</b>		<b>Credit Hours</b>
Management of Forest Resources	Recreation management	1.5
	Habitat management (wildlife & range)	1.5
	Timber management	2.5
	Harvesting	0.5
	Access and roads **	0.5
	Watershed management**	0.5
Measurement of Forest Resources	Biometrics	1.0
Forest Resource Policy/Administration	Policy	1.5
	Economics	1.5
	Sustainable, integrated	
	ecosystem management**	2.0
<b>Total</b>		<b>13.0</b>

\*\* not directly mentioned in the SAF study area descriptions

The reduction in credit hours in FOR 323-326 from 16 to 13 was accomplished by implementing the following changes:

- All subject areas previously taught in FOR 312 were reduced proportionately by the same amount.
- Range management was added to the curriculum.
- An integrative lab was added on Tuesdays.
- Classes on Monday, Wednesday and Fridays were reduced from two 75-minute classes to two 50-minute classes that meet from 9:10-10:00, and 10:20-11:10. The Thursday classes remain unchanged at two 75-minute classes which meet from 9:35-10:50 and 11:10-12:25 but the time of the laboratory was moved from 1:30-4:30 to 2:20-5:15. On Tuesday there were formerly two 75-minute lectures (9:35-10:50 and 11:10-12:25) plus a lab from 1:30-4:30. The change eliminated the 11:10-12:25 lecture and 1:30-4:30 lab and replaced it with a lab that runs from 11:10-3:35.



**3) FOR 413/414: Forest Ecosystem Assessment I & II and FOR 423/424: Forest Ecosystem Planning I & II**

The previous 16-credit hour senior semester was reduced to 12 credits, with 6-credit hours taken in the Fall Semester, and 6-credit hours taken in the Spring. The table below summarizes the changes, and each of the new 6-credit hour blocks will be discussed separately.

<b>Former Course</b>	<b>Was Offered</b>	<b>Current Course</b>	<b>2002/2003 Offering</b>
421A	Fall	413C	Fall
421B	Fall	414C	Fall
421C	Fall	423C	Spring
421D	Fall	424C	Spring

**a) Course objectives – overview**

In addition to serving as the capstone experience in the professional forestry program, FOR 413/414 and 423/424 serve to fulfill NAU's required Senior Capstone Experience. As a capstone experience, this course requires all forestry students to acquire new knowledge and skills, and synthesize the new knowledge and skills with previously acquired knowledge and skills (from both Liberal Studies courses and from other prerequisite courses). The students combine these new and previously acquired skills and knowledge to develop both a strategic and tactical ecosystem forest management plan.

While the fall and spring courses both teach and demand that students show proficiency in many of the identified Liberal Studies essential skills, the courses specifically assess the following three skills: effective writing, quantitative/spatial analysis, and use of computer technology. In addition, transferable skills including technical writing, oral communication, computer skills, group processes, leadership, and time management are emphasized throughout FOR 413, 414 and FOR 423, 424.

#### **4) FOR 413, 414: Forest Ecosystem Assessment (fall semester)**

##### **a) Course Objectives**

The fall sections focus on the assessment of current forest structure and condition as needed to conduct an ecosystem management analysis and forms the first segment of a capstone experience, which integrates material learned in previous forestry courses as well as introducing new concepts. The course includes assessment of information needs, land classification, inventory design, inventory techniques (including field data collection, map preparation, data entry, and database development), forest change modeling, and analysis of current condition.

Instruction revolves around the development of an ecosystem assessment, which considers multiple resources as well as overall ecosystem health. Initially, students work with a provided set of goals, issues and concerns related to a forested management unit. Working in crews, students conduct an ecosystem inventory of the unit. Students are required to develop information needs, land classification, inventory design, inventory techniques, map preparation, data entry, and database development. Students compile and analyze the inventory data to determine current condition, and potential future condition. The current and potential future conditions are compared to goals to provide a first approximation of the changes needed to achieve goals.

##### **b) Changes to FOR 421A and FOR 421B**

FOR 421 A and B was reduced from the current 4 semester hours each to 3 semester hours each (reduction from 8 to 6 semester hours). These courses became FOR 413 and FOR 414. The inventory portion of the course was modified to reduce the amount of time physically collecting data, and increase the time spent on stand-through and landscape-level management and resource planning. The following table shows the distribution of credit hours by subject under the previous 8-semester hour structure and under the current 6-semester hour structure. The new structure of FOR 413, 414 decreased the field inventory component, added explicit competencies in addressing

spatial scale, and added a component of resource planning previously covered in FOR 421C (now FOR 423), as detailed in the table below.

Subject Areas and Credit Hours for Previous (1991/1992 FOR 421 A and B) and current FOR 413 and FOR 414:

Subject Area	Previous Credit Hours	Proposed Credit Hours
Measurement:		
Inventory	4.0	1.3
Volume estimates	1.0	0.5
Sampling: Design and Techniques	1.0	0.5
Surveying and Mapping:		
Photogrammetry	0.5	0.5
GIS Applications	0.5	0.5
Forest Management		
Stand → landscape scale	0.0	0.6
Multi-resource	0.5	0.5
Silviculture		
Growth	0.5	0.5
Forest Policy		
Resource Planning	0.0	1.1
Total	8.0	6.0

## 5) FOR 423, 424: Forest Ecosystem Planning (spring semester)

### a) Course Objectives

The spring sections focus on conducting an ecosystem management analysis and the development of a forest ecosystem management plan, which considers multiple resources and ecosystem health and sustainability. Starting with the current forest condition quantified in FOR 413, 414, students develop desired future conditions for a legacy forest (i.e., forest left to future generations 40 years in the future). Students develop desired legacy forest conditions based on forest ecology and ecosystem management principles learned in FOR 313-316, FOR 323-326, and emphasis area courses.

During the initial phase of strategic planning, students conduct analyses to determine, the specific management which should be undertaken over the next 40 years to achieve goals and address issues and concerns. Criteria for measuring goal achievement are identified and a target is set for each criterion based up natural resource principles. A computerized decision support system is then employed to develop and compare various alternatives for managing the land.

Strategic planning results provide general information on the management which should be implemented during each entry to achieve desired future conditions (the legacy forest). The next planning phase, implementation (tactical) planning, focuses on the first entry. In this phase, more attention is given to the spatial location of management activities identified during strategic planning, and additional criteria, not considered during the strategic analysis, are applied.

The third phase of the analysis involves modifying the strategic plan to address difficulties (e.g., spatial constraints not modeled at the strategic level) discovered in the implementation planning. Students present this final analysis and a second phase of implementation in a written management plan and an oral presentation of analysis results. The final phase of analysis requires identifying information needs (inventory and monitoring) to assess plan implementation and modify the plan in an adaptive manner.

#### **b) Changes to FOR 421E and FOR 421D**

For 421 C and D was reduced from the current 4 semester hours each to 3 semester hours each (reduction from 8 to 6 semester hours). The course content was changed to increase the focus on goal formation through public participation, spatial analysis, and forest health and sustainability. The following table shows the distribution credit hours by subject under the previous 8-semester hour structure and under the current 6-hour structure. The new structure of FOR 423, 424 increased the focus on forest health and sustainability, and added explicit competencies in addressing spatial analysis, and public participation, as detailed in the following table.

Subject Areas and Credit Hours for Previous (1999 FOR 421 C, D) and current FOR 423, 424:

<b>Subject Areas</b>	<b>1991/1992 Credit Hours</b>	<b>Current Credit Hours</b>
Measurement:		
GIS Applications	0.2	1.0
Forest Management		
Forest Health and Sustainability	1.0	1.5
Multi-resource	3.0	1.5
Forest Access	1.3	0.5
Harvesting	0.5	0.5
Policy/Administration		
Public participation	0.0	0.5
Resource planning <sup>1</sup>	1.5	0.0
Budgeting / Finance management	0.5	0.5
<b>Total</b>	<b>8.0</b>	<b>6.0</b>

<sup>1</sup>Moved to FOR 413, 414 subject.

**6) Description of the Professional Program Curriculum as Outcomes, Activities, and Assessment**

The current curriculum was developed as an outcome-based curriculum, as well as the subject-based approach detailed above. This section presents the outcomes, both subject-based and transferable, which we expect students to obtain, the activities designed to help students achieve these outcomes, and assessment used to measure student achievement.

Specified activities are planned activities given the current faculty involved in the courses. Activities are expected to change with changes in technology, faculty involved in the courses, and current issues in forestry. Additional assessment measures for the courses are being investigated. These measures include sending a sample of senior management and implementation plans for review by forestry professionals outside the university and video taping oral presentations and requiring students to assess their own presentations.

**a) FOR 313-316**

Transferable skills developed in FOR 313-316 are presented in Table 2. The subject area outcomes, activities and assessment are presented in Table 3.

**Table 2. FOR 313-316: Transferable Skills and Abilities Described as Outcomes, Activities and Assessment**

Essential Skill	Activity	Assessment Measures
Quantitative skills	Math-based field/lab exercises	Written reports; graded calculations. Graphical presentations
Field measurements	Field/lab exercises; use of measurement technologies	Written reports; graded calculations
Forest sampling	Field/lab exercises	Written reports
Technical writing	Reports	Written reports; Tutoring if needed
Computer skills	Computer labs and homework	Spreadsheet/computer-based assignments

**Table 3. FOR 313-316: Subject Area Outcomes, Activities and Assessment**

Desired Outcomes	Activities	Assessment
<b>Silviculture</b>		
Knowledge/comprehension of land forces controlling forest vegetation – $FV = f(S, CMC, F, H, MM, SSW)*P*T$	Lecture	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of the stages of forest stand dynamics and its manipulation	Readings and lecture	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of basic tree morphology and plasticity and its manipulation – density, crowns & boles	Readings and lecture	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of tree physiological responses to silviculture – leaves and crowns	Readings and lecture	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of site productivity and its manipulation – site index curves and equations	Readings and lecture. Class exercises, Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of stand density effects and its manipulation – SDI and density management diagrams	Readings and lecture. Class exercises. Homework, Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of the role of tree breeding programs – phenotypes (plus trees) and genotypes, seed orchards and grafting	Readings and lecture. Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of nurseries and nursery stock types – bare-root, containerized and combinations	Readings and lecture. Classroom demonstration	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of even-aged stand management: purpose, advantages, concepts and terminology – clearcut, seedtree and shelterwood	Readings and lecture	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of multi-aged stand management: purpose, advantages, concepts and terminology – individual-tree and group selection, BDq	Readings and lecture. Classroom exercises. Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of site preparation and competition control tools and techniques – fire, mechanical, chemical and combinations	Readings and lecture	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of stand density effects and its manipulation – SDI and density management diagrams	Readings and lecture. Class exercises. Homework, Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups

**Table 3. FOR 313-316: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Silviculture (cont.)</b>		
Knowledge/comprehension of artificial regeneration: purposes, advantages, concepts, tools and techniques – direct seeding and planting, seedling survival and spacing	Readings and lecture. Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of natural regeneration: purposes, advantages, concepts, tools and techniques – seed production, dispersal and survival, spatial and temporal patterns	Readings and lecture. Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of prescribed fire and underburning - tools and techniques, fuel types and surveys, ecological restoration	Readings and lecture. Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of thinning tools and techniques – marking guidelines (spacing and limits) and procedures, ecological restoration	Readings and lecture. Classroom exercises. Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of harvesting equipment and proper use – concepts, advantages and terminology	Readings and lecture. Videos. Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Prescriptions for various management objectives: timber production, forest health restoration and maintenance, agroforestry, wildlife habitat enhancement – micro- and macro-scale, watershed and riparian	Readings and lecture. Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of ecosystem management and community/urban forestry implications for silvicultural prescriptions	Readings and lecture. Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
Knowledge/comprehension of dominant silvicultural themes in various regions of the United States	Readings and lecture. Lab	Exams, in-class quizzes. Homework assignments. Weekly lab write-ups
<b>Ecology: Physical Environment/Adaptation</b>		
Comprehension of how environmental and genetic factors affect phenotypes, adaptation, and competition	Lectures, discussions, lab, readings	Comprehensive lab report
C <sub>3</sub> /C <sub>4</sub> pathways, implications for range plant communities	Lectures, discussions, readings	No specific assessment



**Table 3. FOR 313-316: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Ecology: Biotic Environment</b> - forest and range communities		
Review: use of population models in ecology	Lectures, discussions, readings	Quizzes, lab report
Knowledge of factors that influence population size	Lectures, discussions, readings	Quizzes, lab report
Knowledge and comprehension of predator-prey relationships	Lectures, discussions, readings	Quizzes, lab report
Knowledge and understanding of wildlife habitats and habitat relationships including the role and characteristics of ecotones	Lectures, discussions, lab, readings	Quizzes, lab report
Knowledge and comprehension of wildlife and domestic ungulate impacts on vegetation	Lab, readings	Quizzes, lab report
Knowledge and comprehension of biotic interactions in forests	Lectures, discussions, lab, readings	Exams, lab report
Knowledge of definitions, measurement, and arguments about biodiversity	Lectures, discussions, readings	Exams, lab report
Knowledge and comprehension of factors that influence community biodiversity	Lectures, discussions, lab, readings	Exams, lab report
Knowledge of management approaches for maintaining biodiversity	Lectures, discussions, readings	Exams, lab report
Knowledge and comprehension of definitions of disturbance	Lectures, discussions, lab, readings	Exams, lab report
Knowledge of the concept of scale in disturbance, different types of disturbance and their effects on forest and range condition, evolutionary context of disturbance	Lectures, discussions, lab, readings	Exams, lab report
Knowledge and comprehension of the implications of changing disturbance regimes	Lectures, discussions, lab, readings	Exams, lab report
Knowledge and comprehension of succession terminology, and environmental changes during succession	Lectures, discussions, readings	Exams, lab report
Knowledge and comprehension of life history characteristics of early and late successional plants	Lectures, discussions, readings	Exams, lab report

**Table 3. FOR 313-316: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Ecology: Biotic Environment - forest and range communities (cont.)</b>		
Knowledge and comprehension of different theories of succession	Lectures, discussions, lab, readings	Exams, lab report
Knowledge and comprehension of factors that affect rate of succession	Lectures, discussions, lab, readings	Exams, lab report
<b>Ecology: Ecosystems</b>		
Knowledge and comprehension of the hydrological cycle, its components, and factors that influence these components	Lectures, discussions, lab, readings	Exam
Knowledge and comprehension of flows and cycles of elements and energy in ecosystems	Lectures, discussions, lab, readings	Exam
Knowledge of the major factors that influence flows and cycles of elements and energy in ecosystems	Lectures, discussions, lab, readings	Exam
Knowledge and comprehension of the definition, measurement, importance, and major factors that influence ecosystem net primary production	Lectures, discussions, lab, readings	Exam
Knowledge and comprehension of the importance of vegetation/ecosystem classification	Lectures, discussions, readings	Exam
Knowledge of systems of vegetation/ecosystem classification	Lectures, discussions, readings	Exam
Knowledge of vegetation/ecosystem classification tools	Lectures, discussions, readings	Exam
Knowledge and comprehension of the importance of scale in vegetation/ecosystem classification	Lectures, discussions, readings	Exam
Knowledge and comprehension of the relationships between landscape pattern and selected processes	Lectures, discussions, readings	Exam
Transition to Semester B	Lectures, discussions	Exam
<b>Ecology/Entomology/Pathology</b>		
Knowledge of the role of insects and fungi in forest ecosystems	Lecture, discussions, review of class notes	Exam
Knowledge of concepts of forest health	Lecture, discussions, reading of selected literature	Exam

**Table 3. FOR 313-316: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Ecology/Entomology/Pathology (cont.)</b>		
Comprehension of biology, epidemiology, and management of major southwestern forest insects and diseases	Lecture and field trips on recognition of pests	Exam
Comprehension of how forest insects and diseases affect all forest resources including recreation, wildlife, timber	Lecture, class question and answer, discussions	Exam
<b>Products/Wood Technology</b>		
Knowledge of how ecological characteristics and silvicultural practices can affect, and be affected by extraction of forest products	Lecture, class discussion	Exam

**b) FOR 323-326W**

Outcomes, activities, and assessment for transferable skills developed in FOR 323-326W are presented in Table 4. The subject area outcomes, activities and assessment are presented in Table 5.

**Table 4. FOR 323-326W: Transferable Skills and Abilities Described as Outcomes, Activities and Assessment**

Essential Skill	Activity	Assessment Measures
Effective writing	Critical reading and writing assignments, with drafts and revisions.	Papers, draft and final
Oral communication	Oral presentations.	Evaluation of oral presentations
Decision making	Problem definition. Economic analysis for project planning, tree and stand-level decisions. Linear and goal programming analysis.	Laboratory reports, homework assignments and exams
Geographic information systems; Information technology skills	Computer GIS labs, introduction to database tools, growth and yield modeling, partial analysis, use of computer software	Laboratory reports, homework assignments and exams
Working in groups	Group assignments throughout the semester, peer-evaluation of group work	Laboratory reports, homework assignments and exams

**Table 5. FOR 323-326W: Subject Area Outcomes, Activities and Assessment**

Desired Outcomes	Activities	Assessment
<b>Integrated Analysis</b>		
Students understand planning processes and decision-making in a multi-goal and multiple resource context	Integrated case study. --Oral presentations --Lecture --Group discussion	Integrated case study --Oral presentation --Final paper
Students can identify and apply appropriate forestry principles in developing integrated forest plans.	Integrated case study --Oral presentations --Lecture --Group discussion --Case study	Integrated case study --Oral presentation -- Final paper
Students understand how to work as analysts to incorporate stakeholder issues and concerns in goal identification and tradeoff analysis	Integrated case study --Oral presentations --Lecture --Group discussion --Case study	Integrated case study --Oral presentation --Final paper
Students are able to apply forest management principles in a unique, culturally influenced context and are aware of benefits which can accrue to creative forest management.	Integrated case study --Oral presentations --Lecture --Group discussion --Case study	Integrated case study --Oral presentation --Final paper
<b>Recreation Management</b>		
Students will understand the human-nature relationship as reflected in recreation and attitudes toward forest management	Readings on the social acceptance of forest management, Lecture, Discussion	Exam
Students will understand the current demographics of recreation use of wildlands	Lecture, Class discussion	Exam, Essay, writing assignment
Students can describe and apply the prominent recreation management frameworks, including methods for inventorying recreation resources.	Readings, ROS lab, writing assignment; Benefits-based management essay. Discussions of regional recreation planning and management	Benefits-based paper, Exam, ROS lab, writing assignment
Students can describe the most widely used methods used to assess the economic value of recreation	Travel cost, CV, hedonic price method lectures, and readings. User fee lab; user fee paper	User fee paper, Exam
Students can describe the predominant techniques used to assess visual quality	Scenery management system (SMS) and SBE model discussions. Guest lecture, readings. Visual quality writing exercise	Visual quality writing exercise, Exam

**Table 5. FOR 323-326W: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Recreation Management (cont.)</b>		
Students understand the types of resource impacts associated with recreation use and can describe methods for mitigating impacts.	Impact readings, discussion; Limits of Acceptable Change (LAC); Visitor Experience and Resource Protection (VERP) frameworks readings and discussion	Exam
Students understand the social impacts of recreation on local communities	Readings, discussion, Guest lecture	Exam
<b>Biometrics</b>		
Students recognize the significance of different spatial scales	Discussion	Exam
Students learn to apply more sophisticated field methods to estimate forest growth	Lecture, Readings	Exam
Students acquire theoretical and practical knowledge on empirical growth and yield modeling -- whole-stand, size-class and individual-tree stand-growth models -- Multi-stand modeling systems (FVS, LMS)	Lecture, Forest Vegetation Simulator lab	Lab report, Exam
Students acquire a basic understanding of the fundamental aspects of process-based growth modeling	Lecture	Exam
<b>Timber Management</b>		
Students know how goals influence timber management decisions	Lectures; Labs and assignments demonstrating how stand management decisions are influenced by volume maximization, economic efficiency and other goals; Lecture, discussion on stand summation and interaction	Lab assignment, Exam
Students are able to conduct basic valuation and financial analyses, including timber sale appraisal	Lectures; utilized in most stand level labs	Exam
Students can calculate and interpret the physical and financial criteria used to determine optimal management regimes for timber stands	Lectures, Lab exercises	Lab assignment, Exam

**Table 5. FOR 323-326W: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Timber Management (cont.)</b>		
Students understand how silvicultural activities can be employed to enhance goal achievement at the forest level	Lectures, Lab exercises	Lab assignment, Exam
Students understand the functions of problem identification, goals, criteria, variables, constraints, and objective functions in decision analysis	Lecture, Labs, Homework	Lab assignment, Homework, Exam
Students recognize the need to incorporate risk and uncertainty in decision analysis	Lecture, Labs, Homework	Lab assignment, Homework, Exam
Students understand the regulated forest concept and how to achieve regulation under both area and volume control,	Lecture, Labs, Homework	Lab assignment, Homework, Exam
Students are able to formulate mathematical programming models, to apply these models in problem-solving, and to interpret solutions	Lecture, Labs, Homework	Lab assignment, Homework, Exam
Students can formulate contemporary forest management models using linear programming,	Lecture, Labs, Homework	Lab assignment, Homework, Exam
Students understand the concept of product definition and utilization, e.g., logs and log-rules, and their effect on valuation.	Lecture, Labs, Homework	Lab assignment, Homework, Exam
<b>Forest Operations</b>		
Demonstrate their knowledge of the basic concepts of professional ethics	In-class discussions and presentations.	Final exam questions
Demonstrate characteristics of effective leadership	In-class discussions and presentations; Field leadership lab and assignment	Final exam; Quizzes; Lab assignment
Demonstrate knowledge of the basic elements of road design, maintenance, closure, and rehabilitation and how these elements impact forested watersheds	In-class discussions and presentations; Reading; Field lab assignment	Final exam; Field lab exercise ; Quizzes; Lab assignment
Evaluate the impacts of forest management alternatives on erosion and sediment yield, peak flow, and water yield	In-class discussions and presentations; Reading; Field lab assignment	Final exam; Field lab exercise; Quizzes
Demonstrate characteristics of effective leadership	In-class discussions and presentations; Field leadership lab and assignment	Final exam; Quizzes; Lab assignment

**Table 5. FOR 323-326W: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Forest Operations (cont.)</b>		
Demonstrate knowledge of the basic elements of road design, maintenance, closure, and rehabilitation and how these elements impact forested watersheds	In-class discussions and presentations; Reading assignments; Field lab assignment;	Final exam; Field lab exercise ; Quizzes; Lab assignment
Evaluate the impacts of forest management alternatives on erosion and sediment yield, peak flow, and water yield	In-class discussions and presentations; Reading assignments; Field lab assignment;	Final exam; Field lab exercise; Quizzes
<b>Wildlife Habitat Management</b>		
Students will learn how to manage the factors that affect the ability of animals to survive and reproduce	Lectures (review) of population ecology; Lectures on wildlife habitat relationships; Group discussions; Computer simulation of wildlife habitat management; Group habitat management report; Lectures on landscape level movements and considerations	Group report grade; Tests; Quiz
Students will learn how management of other resources affects wildlife populations	Lectures on habitat management and impacts on wildlife; Readings on regional wildlife habitat management strategies; Oral presentations ; Computer simulation of wildlife habitat management; Group habitat management report	Lectures; Group presentation grades
Students will learn how management of other resources affects wildlife populations	Lectures on habitat management and impacts on wildlife; Readings on regional wildlife habitat management strategies; Oral presentations ; Computer simulation of wildlife habitat management; Group habitat management report	Lectures; Group presentation grades
Students will learn how agencies manage wildlife	Agency Forum (class discussion with representatives from AZ G&F, FS, FWS)	Exams ;
Students will understand wildlife as a commodity and of the impact of wildlife on other commodities	Agency Forum; Lectures	Exams
Students will identify and understand single species and multi species approaches to management (ecological indicators, umbrella species, keystone species, functional groups, etc)	Lectures and readings on indicator species concept; Group discussions; Oral presentations (some presentations include monitoring issues) ; ;	Oral presentation grades; Tests

**Table 5. FOR 323-326W: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Wildlife Habitat Management (cont.)</b>		
Students will learn how to inventory, evaluate, and monitor wildlife populations and their habitats	Lectures and readings on monitoring wildlife at stand, forest, and landscape level (implementation, validation, and other types of monitoring); Computer simulation of wildlife habitat management; Group habitat management report;	Exams
Students will contrast wildlife and habitat management values by considering traditional ecological knowledge	Lecture on sustainability of wildlife resources from several Native American cultures; Alaska Controversy lab	
Students will discuss ethical issues in wildlife management	Group discussions; Problem solving exercise	Problem solving exercise grade
Students will discuss key wildlife forestry issues and tools;	Readings; Oral presentations	Oral presentation grades
<b>Policy</b>		
Students can distinguish levels of decision-making: constitutional, social choice, and operational	Readings on levels of decision-making	
Students can identify fundamental sources of values and ideas for the purposes of forest policy in the United States	Readings on environmental ethics, religion, and sustainability; Self-assessment with Kluckholm Value Orientation questionnaire	
Students can connect fundamental values and ideas with the periods of forest and range policy in the United States;	Lectures on emergent properties of culture, structure, and agents in the 19 <sup>th</sup> century, relevant to levels of decision-making	
Students recognize and analyze two contrasting models for public decision-making in the United States, that of the “procedural republic” and “collaboration and politics of place.”	Laboratory Report: Comparison of the Procedural Republic and the Politics of Place (“Decide, announce, defend” vs. “assess, discuss, decide, monitor”); Readings; Lectures	Lab report grades
Students can describe the different ways to define community	Readings on spatial, interest, and cultural definitions of community	
Students can place major past and present policy direction in the US forest sector within one or the other of these two models.	Group presentations on questions describing emergent properties in the 20 <sup>th</sup> century relevant to forest policy and decision-making.	Group presentation grades



**Table 5. FOR 323-326W: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Policy (cont.)</b>		
Students can describe methods of dispute resolution in the procedural republic or local collaboration and communities of place.	Paper evaluating the Committee of Scientists Report	Paper grade
Students can describe the relationships among assessments and decisions at large landscape, small landscape, and project levels.	Reading the COS Report proposals on structuring planning processes. Readings on regional assessments; Paper evaluating the Committee of Scientists Report	Paper grade
Students can describe the distinctive features of a profession and how the profession of forestry is a profession, including the role of ethics in the self-image of a profession.	Group presentations comparing the role of professionals and scientists in the procedural republic compared to collaborative planning/communities of place	Group presentation grades
Students can define science in a public context, the disputes about the role of science in planning, and the connection between the science of forestry and the profession of forestry.	Essay on the role of science: local planning; Essay on the role of science: regional assessments and national policy-making	Essay grades
<b>Range Management</b>		
Students will understand the concept of rangeland and how rangelands differ around the world	Lectures and readings on range management; group management report	Exams
Students will understand the social value of rangeland	Lectures and readings on range management; group management report	Exams, reports
Students will understand the effect of herbivory on rangelands	Agency Forum (class discussion with representatives from BLM)	Exams
Students will demonstrate their knowledge of the process of range assessment and the concept of range condition	In-class lectures; Reading; Field lab assignment	Exams, lab assignment
Students will understand the concept of managing for proper use/carrying capacity of rangelands (e.g., stocking rate, AUMs, distribution, wildlife considerations, and grazing systems)	In-class lectures; Reading; Field lab assignment	Exams, lab assignment

**c) FOR 413-414C / FOR 423-424C**

The outcomes, activities, and assessment for transferable skills developed in the two-semester senior capstone experience (FOR 413-414C and FOR 423-424C) are presented in Table 6. The capstone experience subject area outcomes, activities and assessment are presented in Table 7. In addition to the outcomes described below, the final segment of the capstone course, requires students to write a cover statement for their learning portfolio in which they explain how the pieces in their portfolio relate to what they have learned in their major, and to what they have learned in their liberal studies program.

**Table 6. FOR 413-414C and FOR423-424C: Transferable Skills and Abilities Described as Outcomes, Activities and Assessment**

Essential Skill	Activity	Assessment Measures
Technical writing	Report writing	Management and Implementation plan
Oral communication	Current Conditions oral presentations. Implementation oral presentation	Evaluation of oral presentations
Quantitative and spatial analysis; Advanced Decision Support Skills	Inventory mapping; Linear and goal programming analysis; Implementation plan trade-off analyses; spatial allocation of treatments and road system design	Field and office reviews of map products; in-laboratory consultation with faculty; Management and Implementation plan (oral and written)
Use of technology; Computer Skills	Use of field inventory equipment; Use of computer software; Use of computer-based DSS	Faculty field checks of inventory; Faculty reviews of data entry quality; Management plan
Group Processes	Field inventory crew work, current conditions assessment	Peer and faculty reviews of group effectiveness
Effective Business Skills	Field inventory crew scheduling and coordination, planning inventory tasks, and schedules	Peer and faculty reviews of group effectiveness
Leadership,	Inventory crew leader	Peer and faculty reviews
Public Participation Skills	Interaction with stakeholder groups; (role playing)	Management plan goals, issues, and concerns chapters
Time Management	Field inventory scheduling and coordination. Time management for analysis and write-up of management plan.	Faculty reviews; progress advising for management plan.

**Table 7. FOR 413-414C and FOR423-424C: Subject Area Outcomes, Activities and Assessment**

Desired Outcomes	Activities	Assessment
<b>Forest Ecosystem Assessment</b>		
Understanding of the relationships between goals and objectives and information needs.	Problem assessment. Definition of inventory needs	Goals, issues, and concerns report. Inventory design and procedures paper.
Understanding of the relationships between inventory design and information needs.	Field inventory design, critical review of literature, lectures	Inventory examination. Inventory design and procedures paper.
Understanding of Continuous Forest Inventory (CFI) plots and relation to forest change estimation	Field inventory design, critical review of literature, lectures	Inventory examination. Inventory design and procedures paper.
Ability to conduct forest land classification, and use for transfer of information	Lectures, exercise on land classification. Stand type delineation of analysis area.	Maps of stands and strata (land-types). Land classification exercise report
Introductory understanding of non-traditional forest product inventory, e.g., manzanita, mushrooms	Design of and carrying out special product inventory (product will depend on participating faculty expertise)	Section in current conditions report.
Introductory understanding of human assessment, e.g., assessment of community dependence on forest resources.	Lectures, review of literature, problem assessment.	Goals, issues, and concerns report.
Understanding of Field/office inventory skills	Field inventory	Peer check-cruising. Faculty check-cruising. Inventory examination
Knowledge of project organization / management	Develop time schedule, field inventory procedures, and progress reports.	Plot-specific project work plan, progress reports.
Introductory understanding of database design, ability to effectively use existing database application, understanding of data verification process.	Lecture, field inventory data entry, database verification - quality assurance evaluation.	Faculty evaluation of data quality in completed database.
Moderate level understanding of growth and yield modeling	Growth and yield modeling of current conditions and sustainable forest structures	Management plan chapters on current condition and sustainability analysis.

**Table 7. FOR 413-414C and FOR423-424C: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Forest Ecosystem Assessment (cont.)</b>		
Ability to write technical reports	Report writing	Management plan chapters 1 thru 5 (Introduction, unit description, field inventory procedures, current conditions, sustainability)
Knowledge of effective Geographic Information Systems (GIS)	Mapping component of field inventory, use of Arcview	Inventory maps and database
Ability to work effectively as part of a team	Crew work	Project work plan and progress reports
Ability to lead teams	Leading inventory crew, leading peer check cruise,	Timely completion of inventory tasks; Peer check cruise memos, inter- and intra-crew evaluations.
Effective oral communication of technical material	Current condition oral report	Faculty evaluation of oral report
Understanding of and ability to develop estimates of current forest condition	Integration of all of the above.	Management plan chapters on current condition and sustainability analysis.
<b>Forest Ecosystem Planning</b>		
Understanding the process of goal formation through public participation,	Interaction with groups interested in the forest area (stakeholder) (role playing)	Goals, issues & concern statement
Understanding of the process of how goals and objectives are modified through planning and public participation.	Public participation exercise; dispute resolution exercise	Revised goals issues & concerns
Understanding of the relationships between goals and objectives and management analysis.	Problem assessment. Definition of goal criteria to represent goals, issues, and concerns.	Management plan justification of goal criteria
Ability to specify forest management goals in terms of desired future conditions.	Selection of goal criteria, specification of forest structure.	Management plan justification of desired forest condition.
Ability to quantify desired future conditions.	Selection of goal criteria goal target levels, and desired distribution of structural stages.	Management plan description of desired forest condition for single and multi-resource alternatives.

**Table 7. FOR 413-414C and FOR423-424C: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Forest Ecosystem Planning (cont.)</b>		
Ability to translate forest management problems into mathematical models.	Formulation of forest management models.	Mathematical programming exam; management plan description of model formulation.
Ability to apply principles of timber, recreation, and wildlife management (e.g. economics, ROS and scenery management system, and wildlife habitat relationships) in developing and analyzing management activities.	Timber, recreation and wildlife baseline analysis	Timber, recreation and wildlife baseline reports.
Ability to select silvicultural prescriptions to accomplish specific forest goals.	Selection of forest health, recreation, and wildlife prescriptions.	Management plan sections on prescriptive constraints for forest health, forest protection, and recreational opportunities.
Understanding of biotic factors that influence forest condition and sustainability as related to management goals.	DMR&DMI calculations and interpretation. Bark Beetle risk rating determination. Analysis of post silviculture prescriptions-ratings	Report on Forest health opportunity
Ability to develop stand-specific prescription/marketing guide to address Dwarf Mistletoe concerns WRT goal	Develop stand specific prescription management guidelines. Implement the prescription in analysis model.	Analysis and implementation report.
Advanced DSS skills, ability to analyze and interpret output of mathematical models.	Decision support system analysis, mathematical programming analysis.	Mathematical programming exam; management plan description of model results.
Ability to analyze management plan results in terms of goals, goal criteria, and desired future conditions.	Decision support system analysis.	Management plan justification of selected baseline and final alternatives.
Ability to develop and analyze implementation activities, ability to recognize need for revised planning analysis.	Implementation analysis; revised implementation analysis.	Report on management plan implementation problems; implementation plan.
Ability to conduct revised planning analysis.	Planning analysis to address implementation problems.	Report on management plan revision process.

**Table 7. FOR 413-414C and FOR423-424C: Subject Area Outcomes, Activities and Assessment (cont.)**

Desired Outcomes	Activities	Assessment
<b>Forest Ecosystem Planning (cont.)</b>		
Ability to refine information needs (inventory and monitoring) based on planning and implementation analysis.	Inventory and monitoring needs analysis.	Revised inventory and monitoring design and procedures paper.
Effective business skills, ability to conduct business resource analysis.	Analysis of human, financial, and capital resource capabilities for plan implementation.	Implementation plan presentation
Ability to write technically	Management plan prep.	Management plan
Ability to manage individual time	Project plan development for analysis	Project plan and progress reports
Ability to make oral presentation, and understanding of presentation software	Implementation plan preparation	Implementation plan presentation
Understanding of effective GIS analytical skills	Preparation of management plan and implementation plan maps, tables, and figures	Management plan. Implementation plan. Implementation plan presentation
Understanding of and ability to conduct ecosystem management (multi-resource) trade-off analysis	Decision support system analysis, integration of all of the above.	Management plan

### ***F. Consequences of Structural and Content Changes***

The overall objectives of the four professional semesters are to provide breadth in forest science and management as they have before, while the emphasis areas provide an opportunity for depth in specified integrative areas. The reduction in credit hours, the alignment of class times with NAU class times, and the rescheduling of days on which laboratories occur provide numerous opportunities for students to take additional courses to meet their emphasis area requirements concurrently. Table 8 below indicates times available during each semester for students to take other courses. For example, time is available during FOR 313-316 for students to take classes at 8:00 on T/Th, 8:00 and 9:10 on M, W, F, and after 12:25 on T/Th afternoons. During FOR 323-326, time is available for students to take additional courses at 8:00 every day, and after 11:10 on M, W, F.

During FOR 413, 414 and 423, 424 students can take additional courses on T/Th and there is time after 1:30 PM on M, W, F during the spring semester. This is sufficient time for students to acquire the additional credits needed to complete the emphasis area requirement. Efforts are made when scheduling courses for the emphasis areas to avoid conflicts with the Professional Program, to the extent possible.

**Table 8. Summary of the Professional Program Structure**

<b>Course</b>	<b>Monday</b>	<b>Tuesday</b>	<b>Wednesday</b>	<b>Thursday</b>	<b>Friday</b>
FOR 316-316	10:20-4:20 All-day Integrative Lab	9:35-10:50 Lecture	10:20-11:10 Lecture	9:35-10:50 Lecture	10:20-11:10 Lecture
		11:10-12:25 Lecture	11:30-12:20 Lecture	11:10-12:25 Lecture	11:30-12:20 Lecture
			1:00-4:00 Lab		
Summary: Four 50-minute lecture periods + four 75-minute lecture periods per week = 10 credits Three 150-minute lab periods per week = 3 credits Total: <b>13 credits</b>					
FOR 323-326	9:10-10:00 Lecture	9:35-10:50 Lecture	9:10-10:00 Lecture	9:35-10:50 Lecture	9:10-10:00 Lecture
	10:20-11:10 Lecture	11:10-3:35 Lab	10:20-11:10 Lecture	11:10-12:25 Lecture	10:20-11:10 Lecture
				2:20-5:15 Lab	
Summary: Six 50-minute lecture periods + three 75-minute lecture periods per week = 10.5 credits 2.5 150-minute lab periods (+ breaks) = 2.5 credits Total: <b>13 credits</b>					
FOR 413-414	9:10-10:00 Lecture		9:10-10:00 Lecture		9:10-10:00 Lecture
	10:20-1:30 Lab		10:20-1:30 Lab		10:20-1:30 Lab
	1:50-4:20 Lab*				
* Beginning in week #8, this lab will move to Fridays					
Summary: Three 50-minute lecture periods + nine 50-minute labs per week = <b>6 Credits</b>					
FOR 415-416	9:10-10:00 Lecture		9:10-10:00 Lecture		9:10-10:00 Lecture
	10:20-1:30 Lab		10:20-1:30 Lab		10:20-1:30 Lab
Summary: Three 50-minute lecture periods + Three 150-minute labs per week = <b>6 Credits</b>					



The benefit of adding flexibility to our professional program came at a cost. FOR 313-316 was reduced by 2 credits (the third credit represents the Taxonomy course so is not really lost), FOR 323-326 was reduced 3 credits, and FOR 421 A, B, C, D has been reduced 4 credits. These reductions in credit hours translate into less time available for the subjects taught in these courses. However, as the following Table illustrates, we are still within the range (although slightly below average in most cases) of the credit hours of subjects taught at other peer forestry schools based on the subject areas required for SAF accreditation (Table 9).

**Table 9. Credit Hours by Subject Area for the Professional Program and FOR 211, 212, 213, 220. (Bolded Categories are based on SAF Areas of Study)**

Subject Area	NAU	Other Programs	
<b>Forest Ecology/Biology</b>		(range)	(average)
Dendrology – FOR 220, FOR 212	4.0	3-10	4.1
Forest Ecology – FOR 313-316	7.5	3-16	9.1
Soils – FOR 213	3.0	3-10	4.5
<b>Total</b>	<b>14.5</b>	<b>7-16</b>	<b>11.0</b>
<b>Measurements</b>			
FOR211	3.0		
Biometrics – FOR 323-326W	1.0		
FOR 413-414/423-424C	4.3		
<b>Total</b>	<b>8.3</b>	<b>11-30</b>	<b>20.5</b>
<b>Management (includes social component)</b>			
FOR 323-326W	7.0		
Silviculture - FOR 313-316	5.5	3-8	5.2
- FOR 413-416	0.5		
FOR 423-424	5.1		
<b>Total</b>	<b>18.1</b>	<b>6-21</b>	<b>12.0</b>
<b>Forest Resource Policy/Administration</b> (includes social component)			
FOR 323-326	5.0		
FOR 423-424	2.1		
<b>Total</b>	<b>7.1</b>	<b>N/A</b>	<b>N/A</b>

### ***G. Co-requisite***

To enhance overall student education and to build knowledge in the area of policy, the curriculum requires an upper-division co-requisite class in political science. The course must be taken during one of the four professional semesters and can be selected from a suite of offerings currently identified as POS 344 – Environmental Movements, and POS 359 – Environmental Policy.

### ***H. Integrating Themes***

We believe that beyond sound technical competence, students graduating from the School of Forestry, regardless of major, must possess and demonstrate competence in two additional areas of knowledge: a set of what we call "transferable" skills and a grounding in professionalism. Transferable skills consist of those knowledges and abilities that transcend the profession and have applicability and importance for the career and life success of any graduate regardless of their chosen career path. These skills include such abilities as critical reading and thinking, effective oral and written communication skills, the use of technology, career awareness and acquisition skills. Professionalism includes an understanding of professional ethics, the role of the professional, and professional standards. The transferable skills of career awareness and job acquisition skills link to this larger topic of professionalism. Recognizing these needs, the faculty have already put into place curriculum components to assist students in acquiring and mastering these skills. The purpose of this section is to briefly summarize these existing components as described in the above outcome tables.

#### **1) Writing Across the Curriculum (WAC)**

As part of on-going review of the curriculum during the mid-1990's, the faculty identified a need to improve the quality of student writing skills. This identified need resulted in a set of curriculum changes that came to be known as "Writing Across the Curriculum."

After consultation with the English Composition Program faculty, the Forestry Faculty approved replacing ENG 302 (Technical Writing) with ENG 205 (Writer's Workshop). The goal of this change was to provide students with a more directly complimentary second English composition course than that provided by ENG 302. In addition, again with consultation with the faculty in the English composition program, the Forestry Faculty began developing more explicit writing expectations for students within the forestry curriculum. Desired student learning outcomes were identified, and sequenced through the curriculum. The Forestry Faculty also decided to fund a graduate student from the English department who would work for the School on a half-time basis during the academic year. The graduate assistant (known by various titles, including "Writing Tutor", "Writing Coach", and "Writing Consultant") has the role of assisting both faculty and students with writing. This assistance included working with faculty in the development of an overall evaluation rubric for the programmatic writing expectations, working with individual faculty in the design and evaluation of individual writing assignments, and serving as a source of writing assistance for students.

We feel that the Writing Across the Curriculum program has been, on the whole, very successful. Anecdotally, faculty believe that student writing is improved, and that students and faculty have a clearer understanding of how individual writing assignments fit into the larger programmatic writing goals. To improve WAC, the Faculty have made the following recommendations:

1. That the faculty adopt McMillan, *Writing in the Biological Sciences* as the one REQUIRED writing text for all forestry courses;
2. That a faculty leader be identified who has the responsibility, and commensurate authority, to ensure the coordination of all aspects of the WAC effort, including the consistent use of the common forestry writing rubric across all forestry courses in the curriculum;
3. That faculty meet with the writing consultant to help ensure that writing assignments have clear and consistent expectations; and

4. That WAC goals need more explicit articulation and the identified faculty WAC leader should take the lead role in this process.

## **2) Information Technology Across the Curriculum (ITAC)**

During the Summer of 1999, Don Arganbright, Chair of the School of Forestry, asked a group of faculty to review the technological teaching needs and goals for the School. As a result of these discussions, this faculty group, led by Margaret Moore, developed the "Information Technology Across the Curriculum" (or ITAC) proposal (Appendix D). This proposal identified both desired educational outcomes for forestry students and the hardware necessary to implement the program. The educational outcomes followed the same general pattern as that developed for the WAC, in that desired competencies build through the professional forestry program. The first round of hardware was purchased for ITAC, but budget rescissions for the 1999-2000 and 2000-2001 Academic Years have temporarily delayed the additional hardware purchases. The faculty believe that ITAC well serves our forestry students and recommends its continuation.

### ***1) Professionalism***

Professionalism, in all its manifestations, rests at the core of the forestry program. The current curriculum includes explicit professional elements, from an introduction to forestry careers in FOR 101, through discussions on professional ethics in FOR 313-316 and FOR 323-326, required readings from the *Journal of Forestry* in FOR 313, additional career exploration in FOR 323-326, and leadership skill building in FOR 323-326. The faculty believes that such professional elements are fundamentally important to the major and must be continued. It also believes, however, that the inclusion and treatment of professionalism must receive more deliberate attention throughout the curriculum.

Therefore, the curriculum was modified as follows:

1. The continuation of career awareness elements throughout the professional curriculum, with an increased emphasis on the lower division courses;
2. The relocation of the career development module included in FOR 313-316 from Spring semester to Fall semester (currently included in FOR 313-316);
3. The continuation of the leadership module in FOR 323-326;
4. That required readings from the *Journal of Forestry* be continued throughout the upper division professional curriculum;
5. The continuation of the professional ethics subject matter in all professional semesters;
6. That students are encouraged to become active members of a professional society; and
7. Whenever possible, faculty structure assignments to encourage student participation in region and/or national professional meetings.

### **J. Emphasis Areas**

The School adopted thematic “Emphasis Areas” as a 12-credit requirement within the 120-credit professional forestry Bachelor of Science degree. At least 6 of the 12 credits must be upper division, and the entire package must be 12 credits. The Emphasis Areas allow the students to use the 12 credits plus 7 credits of elective credits available to them, to gain more detailed knowledge in forestry related topics. Each Emphasis Area has a one-page advising sheet to assist faculty; however, a student may choose to design their own 12-credit series by selecting a general forestry emphasis area. This emphasis area requires 12-credits (6 upper + 6 lower division) selected from any regular course with a FOR or PRM prefix. For example, students could assemble a thoughtful mix of two emphasis areas or choose any series of courses within approved emphasis areas to obtain the 12-credit emphasis area. The 12 credits of emphasis area courses derives from reductions in the professional program and emphasis area courses should be professional in nature. The courses used in the Emphasis Area must be approved by the Emphasis Area coordinator(s) and the advisor.

Emphasis Areas are an extension of our professional forestry program, meeting student needs for detailed training (depth and polish) above and beyond a broad forestry degree in an area of their specific interest for study and/or employment consistent with our professional program. Emphasis Areas should be unique and integrative across disciplines. Thus, an Emphasis Area will enhance a student’s overall education while at NAU. We also believe that Emphasis Areas will assist the School’s recruitment goals of new students and transfers from other programs, their retention over time, and ultimate employability. Finally, the unique and integrating nature of our Emphasis Areas will promote our national standing among forestry programs.

### 1) Structural Template

There are six existing Emphasis Areas (Appendix E, Table 10). New proposals are reviewed each year by the SOF Curriculum Committee. New proposals must demonstrate that they are unique and sufficiently different from those already approved.

**Table 10. Summary of Existing Emphasis Areas**

Title	Course Requirements (number of courses)			Potential Student Audience
	Lower Division	Upper Division	New Courses	
Conserving Biodiversity	2	2	0	FOR, others
Ecological Restoration	0	4	0	FOR, others
Forest Health	0-1	3-4	0	FOR, others
International Forestry	2	2	0	FOR,PRM,GGR
Indigenous Forestry	1	3	1	FOR, AIS, Environmental Science
General Forestry	2	2	0	FOR, Environmental Science

## 2) Approval and Renewal Process

Details on the content of the above Emphasis Areas can be gathered from their specific proposals (Appendix E). These proposals, and any future proposals, must include five basic sections:

- 1) Introduction, background and rationale for the emphasis area, including a statement about the uniqueness and integrative nature of the Emphasis Area.
- 2) Course requirements, that clearly delineate existing lower- and upper-division courses, other courses available or planned beyond the core 12 credits (i.e., other good supporting electives), and new courses that need to be developed to support the Emphasis Area.
- 3) Suggested Liberal Studies classes, as a short-list from which students might choose.
- 4) Likely sequence that a student would follow, detailing courses and activities prior to the professional program versus during the professional program. This becomes the one-page advising sheet.
- 5) Outcomes and assessments of effectiveness for that emphasis area.

Proposals are actively promoted to students for **five years only** beginning the year of approval (i.e., they are planned with a sunset clause); after that time period, the proposal must be resubmitted by its originator(s) with any necessary or desired modifications. Enrollment numbers in individual courses and a cost-benefit analysis associated with that enrollment are only part of the evaluation of an Emphasis Areas. There is no particular maximum number of Emphasis Areas, but the faculty is concerned that too many will negatively influence the cost-benefit analysis - too few students in too many classes.

## ***K. Curriculum Assessment***

Assessment within the forestry curriculum has two components: the assessment of individual student learning outcomes and overall program assessment.

With regards to the former, the faculty believes that our current unit/course-based evaluation system provides sound and comprehensive methods of evaluating individual student learning outcomes. The evaluation of students has many desirable elements including multiple evaluation modes (*e.g.*, oral presentations, written examinations, writing portfolios, field examinations, etc.) and clear evaluation criteria (*e.g.*, the writing rubric). What the major does not have is a single, comprehensive "exit" examination. Given the measures already in place, and the cost and resources necessary to implement such a comprehensive examination, the faculty has not accepted such a requirement.

The faculty believes that we can improve the assessment of the program through a more systematic and deliberate use of the capstone management planning documents produced by students in FOR 413-414 and FOR 423-424. By reviewing a subsample of these documents on a regular and on-going basis, the faculty has an extremely powerful tool for program assessment. To maximize the power of this procedure will require that the faculty devote time to the development of explicit evaluation criteria against which we can review the planning documents.

## ***L. Learning Assessment***

### **1) Development Process**

The assessment measures used in the undergraduate forestry program have developed over time. The identification of desired educational outcomes is, however, a more recent phenomenon. In December 1994 the faculty began a comprehensive review of the undergraduate forestry major with the goal of identifying key competencies. This work was completed in 1995, with the results reported as part of a peer-reviewed article (Fox et al. 1996<sup>2</sup>). As noted in the literature (Sample et al. 1999), the faculty has adopted an "adaptive curriculum management" approach whereby we look at and review the curriculum on an on-going basis. The first major review of the curriculum, including

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<sup>2</sup> Fox, Bruce E., Thomas E. Kolb, and Ernest A. Kurmes. 1996. "An integrated forestry curriculum: The Northern Arizona University experience." *Journal of Forestry*. 94(3):16-22.



assessment measures, occurred in 1996; the latest in 1999. The latest review included an explicit assessment component. In addition, as part of this review structure, we explicitly address our desired educational outcome goals for forestry students in the program; i.e. to answer the question “What do we want an NAU forestry graduate to be?”

## **2) Student Learning Outcomes**

As a professional program, we also have the benefit of professional surveys of skills desired by prospective employers. Coupled with the work undertaken by the faculty, noted above, in sum, these different sources proved a rich list of desirable educational outcomes for the forestry students. For our forestry students, our senior capstone course is used as a mechanism to evaluate and assess overall student achievement levels in a variety of areas, including technical forestry knowledge and written communication skills. Tables 11 and 12 summarize key desired learning outcomes, the activity (ies) where students will learn/develop these outcomes, and the assessment measures to evaluate student mastery. These key outcomes will form the basis of developing a systematic program assessment procedure. Many of these outcomes reflect a developmental process throughout the professional curriculum, and are not all taught in the capstone experience.

**Table 11. Fall semester Forestry 413-414, key educational outcomes, activities, and assessment measures for development of programmatic assessment measures.**

Essential Skill	Activity	Assessment Measures
Field/office inventory skills	Field inventory	Peer check cruising; Faculty check cruising; Inventory examination
Project organization and management	Field inventory	Project work plan
Understand data entry and verification	Field inventory data entry	Lead crew quality assurance
Introductory level understanding of growth and yield modeling	Growth and yield modeling of current conditions and sustainable forest structures	Management plan chapters 4 and 5
Technical writing	Report writing	Management plan chapters 1 thru 5
Effective GIS user	Mapping component of field inventory	Inventory map and database
Ability to work effectively as part of a team	Crew work	Project work plan and progress reports
Team leadership skills	Lead crew organization, peer check cruising, lead crew database quality assurance	Peer check cruising report

**Table 12. Spring semester Forestry 423-424, key educational outcomes, activities, and assessment measures for development of programmatic assessment**

Essential Skill	Activity	Assessment Measures
Understanding of multi-resource trade-offs; Decision support system analysis	Management plan	Management plan
Technical writing	Management plan preparation	Management plan
Developed individual time management skills	Project plan development for analysis	Project plan and progress reports
Advanced DSS skills	Decision support system analysis	Management plan
Effective oral presentation skills, including presentation software	Implementation plan preparation	Implementation plan presentation
Effective GIS analytical skills	Preparation of management plan and implementation plan maps tables, and figures	Management plan; Implementation plan; Implementation plan presentation

### **3) Evidence and Measures**

The assessment of these skills is not as fully developed and robust as their identification. As with many, if not most, academic programs, we rely heavily on course-imbedded assessments of student achievement. Within the professional forestry program these measures include traditional in-class examinations, field-based examinations, group work, and peer evaluations. The Forestry Program does include two additional assessment measures, one that assists with overall program evaluation, and the second that provides feedback on both programmatic achievement and student academic achievement.

First, at the end of each of the three professional semesters, the students participate in a “facilitated” evaluation of the semester. An outside consultant is hired who conducts each of the evaluations. Working with the consultant, the faculty provides a list of questions to serve as discussion points, although discussions are not confined to these topics. No faculty are present during the evaluations. These evaluations provide a valuable source of program assessment in that they help the faculty assess what has “worked” and “not worked” for students in a given semester (and why), and also provides information to use to help the effectiveness of inter-semester integration.

Second, students prepare a comprehensive management plan, including a field inventory data collection component, in their senior year in FOR 413-414 and FOR 423-424. These courses are used as a mechanism to evaluate and assess overall student achievement levels in a variety of areas, including technical forestry knowledge and written communication skills. The senior courses as a vehicle to assess overall program goals with respect to student learning outcomes in that it serves to help identify which areas in the curriculum may need additional attention.

Also, in 1997 the School conducted an alumni survey that asked alumni to rate both the quality of their education and the importance of different skills and abilities at different points in their professional careers. We are currently carrying out a similar survey, to

inform the faculty as we work on our adaptive mode of curriculum revision (Fox et al. 1998<sup>3</sup>).

#### **4) Feedback**

Currently, we anticipate continuing with the assessment structure outlined above, subject to revision based on our current in-process curriculum review. More specifically, we will continue with the adaptive curriculum process, where the faculty involved in each semester's course delivery have the primary responsibility for assessing that delivery. These faculty groups then develop curriculum modifications for implementation, keeping in mind the desired semester-based and programmatic student learning outcomes. When these faculty groups and/or administrative leadership in the School, believe that intra-semester adjustment can no longer achieve desired outcomes, then a more comprehensive overall review is undertaken.

#### ***M. Course Evaluation***

The School of Forestry uses a formal evaluation process to elicit student critiques of course and instructors. A standard evaluation form (Appendix F) is administered in each forestry course each semester for each faculty member. In the integrated, team-taught courses where several subject areas and instructors may be involved; each distinct subject and/or instructor is evaluated separately. The evaluations are typically administered following the final exam for the course or instructional unit. All students in the class are urged to participate, but participation is voluntary. The anonymity of the participants is preserved. Average and composite values are computed both by item and overall. The summary data, and the forms with students' written comments are provided to the faculty member and to the Chair.

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<sup>3</sup> Fox, B.E., L.E. DeWald, T.E. Kolb, M.E. Lee, D.B. Wood. 1998. "Assessing a Forestry Education". Second Biennial Conference on University Education in Natural Resources. *Natural Resources and Environmental Issues*. Volume 8. Pp. 81-86. College of Natural Resources. Utah State University.

The students' responses are used to obtain creative ideas from students for course improvement and to detect problems or unwanted trends in teaching effectiveness when a trend among students is apparent. Marginal curricular adjustments are made on an annual basis as a result of student evaluations. Further, the Chair utilizes these evaluations for the purpose of annual appraisals of program and faculty performance.

Due to the team-teaching format of the curriculum, there is also an ongoing informal interchange of ideas and suggestions for improvement among the faculty involved in the same instructional portion of the professional program.

### **Standard III. Organization and Administration of the Forestry Program Organization**

#### ***A. Organization***

The School of Forestry is one of three academic units in the College of Ecosystem Science and Management (CESM) (Fig. 2). The School's administrative head is a Chair similar to the other two academic programs in the CESM. All have equal authority and autonomy. The College is one of twelve Dean-level academic units at Northern Arizona University as is shown in the NAU Organization chart (Fig. 3)

#### ***B. Authority***

Program planning and budgeting at Northern Arizona University are accomplished at two different levels. The President is responsible for both campus-wide global planning and overall budget allocations to the academic and non-academic programs. The Provost makes annual allocations to the Colleges. The Dean of the College of Ecosystem Science and Management makes an annual budget allocation to the three academic programs under her/his purview. The program chairs are in turn completely responsible for further capital and operations budgets within their program including fiscal responsibility. The

Dean in consultation with the chairs is responsible for any recommendations based on merit, market adjustment, and equity adjustment.

Considerable authority is provided to deans and in the CESM to chairs to fulfill responsibilities to enhance program quality. Chairs and their faculty are given full authority to develop mission and scope statements and planning objectives in their strategic plans. The Dean and Provost have always accepted these plans without change.

The School of Forestry has developed three long term planning documents, one in 1984-85, one in 1991-1992 and the most recent one in 1995-1996 to chart decadal development of programs. Many of the goals presented in the 1995-1996-program plan have been implemented. This includes changes in curriculum, research program thrusts, improvements in facilities, and the recruitment of new faculty. Since the last On-Site visit in Spring 1992, the Dean and Provost have approved all recommendation for faculty sabbaticals, major salary adjustments, and hiring recommendations made by the Chair(s) of the School of Forestry.

The ability of the Chair to influence faculty and staff salaries, program direction and change, and program facility and capital expenditures largely depends upon and demonstrates the administrator's ability to effectively manage academic programs.

### ***C. Autonomy***

As just noted, the Dean and academic chairs of the College have considerable autonomy in planning, development, championing, and implementing academic programs in the areas of education, research, and service. Since the last On-Site Visit, the School has independently developed long-term program plans, which have been implemented via close working relationships with the Dean, central NAU administration, the Board of Regents, and local natural resource groups. These have include a new Decision Package for undergraduate research in ecological restoration, the creation of the Institute of Ecological Restoration, the 48,000-acre Centennial Forest, the Park Ranger Training

Program, the Grand Canyon Forest Partnership and the Sustainable Forestry in Tropical Ecosystems program with ESNASCIFOR in Siguatepeque, Honduras among others. In general the School's Strategic Plans and annual staffing plans have been accepted with minor modification by the NAU administration.

#### ***D. Support Staff***

The School of Forestry has a small but effective support staff consisting of the following positions:

- Administrative Assistant -- Full Time
- Office Specialist – Full time
- Manager Information Technology – Full time
- Senior Support Systems Analyst – Full Time
- Senior Research Specialist – Full Time
- Student Services Coordinator – Part time
- Equipment and Vehicle Manager – Part time
- IT Help Desk staff – two 0.5 FTE Part time

A cadre of student workers who collectively staff the College's Support Services Office full time also supports the School. They provide standard office support such as Xeroxing etc.

Several positions have been lost in the past three years as a result of state budget cuts to the University. These are:

- Development Director – Full time (shared with the College)
- Student Services Coordinator – Full time
- Application Systems Analyst – Full time
- Equipment and Vehicle Manager – Full time

The loss of the development director and full time Student Services Coordinator has had the greatest impact. Never the less we believe the faculty and students in the School are being adequately served.

### ***E. Program Planning***

As indicated earlier, the School has over the past two decades carried out formalized strategic planning efforts. The last strategic plan was completed in 1996. The current chair has indicated that the School will initiate another such effort in 2003/2004.

Several other planning efforts have been conducted since the 1996 strategic plan. These include the *Report of the Professional Curriculum Review Committee to the School of Forestry Faculty – Maintaining Leadership in Innovative Forestry Education* and an analysis of the School's potential role in distance learning entitled *Enrollment and Distance Learning Committee Report* (April 5, 2000).

The School is also currently carrying out another undergraduate alumni survey of the teaching program. We are in hopes of having the results for the Visiting team when they arrive. A copy of the survey that was sent out can be found in Appendix G.

As a general rule a committee appointed by the Chair carries out planning initially. The entire faculty is, however, responsible for review of any recommendations and document that is produced. Students and alumni have not historically been involved other than in seeking their input into education satisfaction.

The School is currently discussing both internally and with the Provost a plan to have the School return to a stand-alone academic unit with its own dean. It appears highly likely that this will occur. In this event the current Park and Recreation Management faculty and undergraduate program would merge with the existing Department of Geography and Public Planning and move administratively to the College of Arts and Sciences. The Department of Applied Indigenous Studies would most likely move to the College of



Social and Behavioral Sciences. The Forestry faculty almost unanimously supports the change and believes it will strengthen the Forestry program both on and off campus.

### ***F. Educational Outcomes Assessment***

The School's educational outcomes assessment was discussed in detail under Standard II Section L and hence will not be repeated here.

## **Standard IV: Faculty**

### ***A. General Information***

Documents C "Forestry Program Faculty Background" and D "Academic Summary" follow Document E Individual Faculty Information can be found in Appendix H. No School of Forestry faculty member holds a joint appointment with other departments on the NAU campus.

In the Academic 2003, the School of Forestry had 23 tenure-track faculty teaching in the undergraduate program. One of these faculty, Bruce E. Fox, is not currently teaching in the Forestry Program as he is serving as Director of the NAU Honors program. A second faculty member Steven Dewhurst was just hired and will join the School in Fall 2003. He is currently teaching at The University of Northern British Columbia. Finally the School had one part-time faculty member, Jullian Worssam, who teaches the School's three environmental education courses FOR 403 – Project Learning Tree, FOR 404 – Project Wild, and FOR 405 – Project Aquatic.

The figure of 23 faculty does not include Park and Recreation Management faculty who also hold appointments in the School, none however, teach Forestry courses. No other faculty from other NAU academic program teaches in the Forestry Program.

## FOREST RESOURCES PROGRAM FACULTY BACKGROUND SUMMARY (DOCUMENT C)

Institution Name: Northern Arizona University, School of Forestry

Academic Year: 2002/2003

Faculty Member <sup>1</sup>	Academic Rank	12mo./9mo.	Major Field	Highest Degree Held Degree/Yr./Inst.	Experience (years)		
					Present Inst.	Other Inst.	Non-Academic
Alcoze, T.	Professor	9 month	Restoration Ecology & Indigenous Knowledge	Ph.D./1981/ Michigan State University	14	13	0
Arganbright, D.	Professor	9 month	General forestry and natural resource conservation	Ph.D./1971/ University of California-Berkeley	8	31	0
Bailey, J.	Associate Professor	9 month	Silviculture	Ph.D./1997/ Oregon State University	7	6	9
Beier, P.	Professor	9 month	Wildlife Ecology and Conservation Biology	Ph.D./1988/ University of California, Berkeley	10.5	6.25	.3
Chambers, C.	Associate Professor	9 month	Wildlife Ecology	Ph.D./1996/ Oregon State University	7.5	8	0
Covington, W.	Regents' Professor	9 month	Forest Ecology	Ph.D./1976/Yale University	28	0	0
Daugherty, P.J.	Interim Chair, Associate Professor	12 month	Forest Management and Economics.	Ph.D./1991/ University of California, Berkeley	11	1	0

Faculty Member <sup>1</sup>	Academic Rank	12mo./9mo.	Major Field	Highest Degree Held Degree/Yr./Inst.	Experience (years)		
					Present	Other Inst.	Non-Academic
DeWald, L.	Associate Professor	9 month	Forest Genetics and Conservation Biology	Ph.D./1986/ Virginia Polytechnic Institute & State University	8.5	5	0
<sup>1</sup> Dewhurst, S.	Assistant Professor	9 month	Forest Management	Ph.D./1999/Norther Arizona University	N/A	8	N/A
Fulé, P.	Assistant Professor	9 month	Ecological Restoration and Fire Ecology	Ph.D./1996/ Northern Arizona University	5	0	4
<sup>2</sup> Fox, B.	Professor	9 month		Ph.D./1980/University of Michigan	17	6	7.7
Hart, S.	Professor	9 month	Forest Ecology	Ph.D./1990/ University of California, Berkeley	11.5	.5	0
Hospodarsky, D.	Associate Professor	9 month	Forest Sociology	Ph.D./1993/ Oregon State University	11	0	0
Kim, Yeon-Su	Assistant Professor	9 month	Natural Resource Economics	Ph.D./1998/ Oregon State University	4.5	0	0
Kolb, T.	Professor	9 month	Forest Ecology and Tree Physiology	Ph.D./1988/ Pennsylvania State University	10	5	0
Larson, R.	Professor	9 month	Wood Technology	Ph.D./1976/ Colorado State University	27	0	0
Lee, M.	Associate Professor	9 month	Wildland Recreation	Ph.D./1991/ Oregon State University	12	0	0
Mathiasen, R.	Associate Professor	9 month	Forest Health, Forest Pathology	Ph.D./1977/ University of Arizona	13	1	9

Faculty Member <sup>1</sup>	Academic Rank	12mo./9mo.	Major Field	Highest Degree Held Degree/Yr./Inst.	Experience (years)		
					Present	Other Inst.	Non-Academic
Moore, M.	Professor	9 month	Forest and Range Ecology, Landscape Ecology, GIS/Remote Sensing	Ph.D./1987/University of Minnesota	16.5	3	0
Parysow, P.	Assistant Professor	9 month	Forest Biometrics	Ph.D./1998/University of Illinois at Urbana-Champaign	3.5	2	0
Tecle, Aregai	Professor	9 month	Hydrology and Decision Systems Analysis	Ph.D./1988/ University of Arizona	14.5	13.5	0
Trosper, R.	Professor, Director Native American Forestry Program	9 month	Ecological Economics, American Indian Economic Development, Forest Policy	Ph.D./1974/ Harvard University	14	8	0
Wagner, R.	Regents' Professor	9 month	Forest Entomology	Ph.D./	On Sabbatical		
Worssam, J.	Instructor	9 month p/t	Environmental Practices	MA/2002/Northern Arizona University	3		10

<sup>1</sup> Will join School Fall Semester 2003.

<sup>2</sup> Currently serving as Director of the NAU Honors Program.

**FOREST RESOURCES PROGRAM FACULTY ACADEMIC SUMMARY (DOCUMENT D)**

Institution Name: Northern Arizona University, School of Forestry

Academic Year: 2002/2003

Faculty Member <sup>1</sup>	Budgeted Time Allocation (%)			All Courses Taught						
	Teaching	Research	Service	Short Title	Course#	Credit Hours	Contact Hours	Total Enrollment		# of UG Advisees
								Undergrad	Grad	
Alcoze, T.	50	25	25		FOR 270 FOR 370	3 3		16		5
Arganbright, D.	40	10	50		FOR 326W	1.5		29		25
Bailey, J.	70	20	10		FOR 212 FOR 315 FOR 316 FOR 381 Web based FOR 212w FOR 692	2 3 3 3 3 2		58 36 36 18 21	19	13
Beier, P.	50	40	10		FOR 240 FOR 504 FOR 690 FOR 698	3 3 3 2		25 0 0 0	0 14 16 11	7
Chambers, C.	60	30	10		FOR 255 FOR 325W FOR 506 FOR 398	3 1.5 1 3		22 29 5 1	6	8
Covington, W.	50	40	10		FOR 580	3			8	1
Daugherty, P.J.	100% Administrative (Chair)									0

Faculty Member <sup>1</sup>	Budgeted Time Allocation (%)			All Courses Taught						
	Teaching	Research	Service	Short Title	Course#	Credit Hours	Contact Hours	Total Enrollment		# of UG Advisees
								Undergrad	Grad	
DeWald, L.	70	20	10	Web based	FOR 101	3		67		7
					FOR 313/314	8 3		30		
					FOR 611	3			8	
					FOR 250	3		53		
					FOR 693				2	
Fulé, P.					FOR 382/582	3		16	13	7
					FOR 382H	3		3		
					FOR 506	3			10	
					FOR 380/580	3		18	8	
					FOR 380H	3		5		
					FOR 551	3			21	
					FOR 551L	1			13	
Hart, S.	50	40	10		FOR 498	1,1		2		4
					FOR 698	1,1			14	
					FOR 313/314	6		31		
					FOR 213	3		42		
					FOR 521	3			8	

Faculty Member <sup>1</sup>	Budgeted Time Allocation (%)			All Courses Taught						
	Teaching	Research	Service	Short Title	Course#	Credit Hours	Contact Hours	Total Enrollment		# of UG Advisees
								Undergrad	Grad	
Hospodarsky, D.	70	20	10	Reg. Plan	PRM 360 FOR 499 FOR 211 PRM 430 FOR 690 FOR 423C FOR 424C	3 3 3 3 3 6		31 3 34 8 20	15	25
Kim, Yeon-Su	70	20	10	Reg. Plan	UC 101 FOR 440 FOR 499 FOR 423C 424C	3 3 3 6		25 5 3 20		10
Kolb, T.	50	30	20		FOR 220 FOR 212 FOR 212wb FOR313/ 314	2 2 2 1.6		24 55 19 31		8
Larson, R.	70	20	10		FOR 101 FOR 222 FOR 541	3 3 3		37 15	4	6
Lee, M.	70	20	10		PRM 346 FOR 325W FOR 500 FOR 692 FOR 445	3 1.5 3 2 3		25 29 9	19 19 1	12

Faculty Member <sup>1</sup>	Budgeted Time Allocation (%)			All Courses Taught						
	Teaching	Research	Service	Short Title	Course#	Credit Hours	Contact Hours	Total Enrollment		# of UG Advisees
								Undergrad	Grad	
Mathiasen, R.	50	40	10		FOR413/ 414	3		20		10
					FOR 250	3		30		
					FOR 454	3		13		
					FOR 554				11	
Moore, M.	50	40	10		FOR 101	3		50		8
					FOR 220	2		25		
					FOR313/ 314	1 3		31		
					FOR 544				6	
Parysow, P.	50	40	10		FOR 211	3		34		6
					FOR 413/ 414	4		20		
				Indep Study	FOR 697	2			1	
					FOR 603	3			5	
					FOR323w/ 324w	1		29		
Tecele, A.					FOR 324	3		29		6
					FOR 340			10		
					FOR 340L			7		
				WS Restor. Indep Study	FOR 506	8				
					FOR 506	2				



Faculty Member <sup>1</sup>	Budgeted Time Allocation (%)			All Courses Taught						
	Teaching	Research	Service	Short Title	Course#	Credit Hours	Contact Hours	Total Enrollment		# of UG Advisees
								Undergrad	Grad	
Trosper, R.	50	30	20		FOR 326W/ 326W FOR 633 AIS 490	13 3 3		29	7	5
Wagner, R.	On Sabbatical									0
Worssam, Jillian	Seasonal				FOR 403	1		24		0
					FOR 404	1		24		
					FOR 405	1		24		
					FOR 499	1		24		
					FOR 499	1		24		

## ***B. Diversity***

The School of Forestry is committed to fully meeting the letter and spirit of NAU's legal and desired obligations in the areas of affirmative action, equal opportunity and nondiscrimination, and the Americans with Disabilities Act (ADA) and in diversity. The School works closely with the Office of Affirmative Action and Multicultural Affairs when hiring any new faculty or staff member.

The School is particularly proud of the diversity of our faculty. Women and minorities make up 34.7 percent of the faculty. This is broken down as follows:

Females – 5

Native Americans – 2

Hispanic – 1

Asian decent – 1

The School is one of the few programs on campus that currently not only meets, but exceeds NAU's affirmative action goals.

## ***C. Faculty Recruitment and Retention***

At Northern Arizona University, as at all institutions, an established procedure exists for the selection of new faculty to be added to an academic unit, and promotion of the faculty once selected. In long-term planning, and annual strategic planning, the Chair and faculty are permitted to forward their recommendations for the type of faculty to be recruited to their academic units. Approval for the appointment of a new faculty member, and related monies are approved by the Provost and the President. Once the approval for recruitment is given through the strategic planning process, the Chair and faculty have authority to develop position criteria, and standards and expectations, as well as recruitment procedures. The Provost normally reaches an agreement with the Dean and the Chair on salary and selected conditions of hire. The Office of Affirmative Action

and Multi Cultural Affairs reviews the entire process to assure compliance with established NAU policy.

A faculty screening committee, made up of at least five forestry faculty members, recommends two to three candidates to the Chair including additional recommendations on individual capabilities. The Chair makes a recommendation to interview the candidates, which is generally approved by the Dean and Provost. During the interview process, the Chair develops the conditions for hiring a selected candidate, and gives this recommendation to the Dean and Provost. In Forestry, in the last seven years, almost all recommendations have been approved by the Dean and Provost.

For promotion of faculty, a standard, university-wide process is employed. The faculty member makes an application for promotion to the School's Faculty Status Committee (FSC), and the FSC makes a recommendation for promotion and/or tenure to the Chair. The Chair makes a recommendation to the Dean who seeks the evaluation of the College Committee on Promotion and Tenure. Finally the Dean sends his/her recommendation together with that of the School's faculty, the Chair and CESM Promotion and Tenure Committee to the Provost. Only the President has the vested authority to promote or tenure faculty.

In the last eleven years, the Chair(s) has always sustained the FSC, and the Provost has always sustained the Dean's recommendation. In no case has the President overturned the recommendation by the Dean and Provost.

At NAU, authority to establish requirements for degree offerings is vested in the Board of Regents. However, in practice, the faculty and Deans' recommendations for degree requirements in a specific program are generally sustained by the central administration and the Board of Regents. Procedurally, a complete academic programming document, including specific curriculum and resource requirements for degrees offered, is developed by the faculty and Dean for submission to the University Curriculum Committee, or the University Graduate Council for graduate matters. Approvals by the committee and the

Provost and the President places the completed recommendation with the Board of Regents for approval. Generally speaking, these recommendations are sustained by the Board of Regents unless political problems surface, generally resulting from program or curriculum overlap among in-state universities.

#### ***D. Faculty Adequacy***

We believe that the 23 Forestry faculty, who represent great diversity in terms of areas of expertise, ethnic diversity, gender and overall experience, are adequate in carrying out our educational, research, and service objectives. This belief does not mean, however, that the School does not need additional faculty to meet the increasing demands being placed upon it by our expanding research and service programs.

#### ***E. Availability and Use of Innovative Teaching Methods and Materials***

The School of Forestry constantly experiments with innovative teaching approaches, materials, and equipment. The School continues to develop a unique team teaching format for its professional curriculum, described in Standard I. Utilizing this teaching procedure has a requirement for developing materials from segments of many different texts and science journals and integrating it into an instructional unit. The methodology incorporates practicing professionals, interdisciplinary faculty, extensive writing, team interaction and problem solving, extensive written and oral presentation, and extensive use of computers and software. In general, it invokes an interdisciplinary multiresource problem solution approach to the forest management curriculum. These innovative teaching approaches are enhanced by the School's commitment to its mission research program to make innovative teaching materials and curricula an output of the research process. Faculty are also now employing advanced video graphics, and real time modeling in their instruction. Also, interdisciplinary field labs are used to demonstrate lecture concepts.

## ***F. Sabbatical and other faculty development techniques***

Northern Arizona University and the School of Forestry recognize faculty sabbaticals as an important faculty development program. Faculty are eligible for sabbatical release after six years of continuous service. All requested faculty sabbaticals have been approved by the Provost and honored since the last On-Site Visit. Sabbaticals are encouraged in the School of Forestry because of their positive role in faculty development. A list of faculty that have elected to take sabbaticals in the last six years follows. Other faculty have been eligible, but have preferred to delay this opportunity.

Faculty who have taken sabbaticals during the 1996-2002 period are:

Alcoze, Thomas M. --- 2000-2001

Beier, Paul --- 1999-2000

Covington, W. Wallace --- 2000-2001

Hart, Stephen C. --- 1997-1998

Hospodarsky, Denver C. --- Fall Semester 2001

Lee, Martha E. --- Fall Semester 2001

Moore, Margaret M. --- 2000-2001

Trosper, Ronald L. --- 1997-1998

Wagner, Michael R. --- Calendar year 2003

## ***G. Workload allocation***

Faculty workload allocations in teaching, research and service are determined through discussion between an individual faculty member and the Chair. Faculty preference is the starting point for this negotiation. Adjustments to these preferences are necessary for the Chair to accommodate the teaching requirements of the Program. However, most of the requests of the faculty can and have been fully honored. In general, the faculty are permitted to teach up to 80 percent, or as little as 30 percent of their total work commitment. Faculty are required to carry at least a 10 percent research load and allowed up to a 60 percent research load. The allowable service workloads range from 10 to 30

percent. Expectations of productivity vary with workload percent for all categories. The School believes this approach best maximizes the varying and changing capabilities and desires and hence productivity of the faculty. Minimums have been set in service and scholarship to accommodate the individual faculty requirements for student advising/mentoring and institutional professional service as well as scholarly development.

## **Standard V: Students**

### ***A. Admission Requirements***

Several strategies are employed to inform prospective students of the philosophy, objectives, and areas of emphasis of the School of Forestry and the forestry profession.

Students requesting general information, either by mail, phone, or through the NAU Admissions Office, are sent an appropriate personalized form letter from the Chair, a brochure, and an advisement sheet (see Appendix I for copies of these materials).

Students who request specific information not covered in the above packet receive a personal letter or phone call from the Schools' Student Services Coordinator, as well as the standard materials.

The personalized letter and informational packet is sent to each prospective student whose name appears on a periodic ACT summary list of high school juniors and seniors who have expressed an interest in studying forestry at NAU, and whose ACT scores and/or other criteria meet the university's admission requirements. Prospective students visiting the campus at Flagstaff (scheduled or "drop in") receive a detailed explanatory conference with the Student Services Coordinator or a faculty member.

Twelve "On-Campus Information Days" or Previews are organized by the NAU Office of Orientation, Transition, and Retention Services (OTRS) and held on campus each year

together with two regional sessions. At these events, high school seniors, transfer students, and their parents have the opportunity to visit Northern Arizona University and to explore their choices for career programs. Students expressing an interest in forestry are hosted by the Chair and Student Services Coordinator of Academic Programs at two half-hour sessions.

Several hundred prospective undergraduate students are contacted through at least one of the above methods each year. An effort is made to provide each student contacted with a realistic explanation of the career opportunities in the forestry profession, the rigors of the integrated professional program, and the current and projected status of the job market.

Articulation agreements with all Arizona community colleges, Haskell Indian Junior College in Kansas, serve as recruiting devices through the contact with advisors at each institution.

### **1) Undergraduate Admission and Retention**

Admission requirements for freshman and transfer students are specified on pages 18 through 25 of the Northern Arizona University 2001-2003 Undergraduate Catalog. Lower-division forestry majors are admitted to the University based on these criteria.

During the freshman and sophomore years, attrition patterns of forestry majors are mainly determined by a self-selection process, as certain students discover in the introductory forestry classes and other required coursework that the profession is not what they visualized and/or their academic performance would make them marginal candidates for acceptance into the upper-division professional program. Assistance and referral is provided by the Coordinator of Student Services, advising faculty, the University Counseling Center, and the University Advisement Center to ensure adequate career guidance, advising, and counseling to these students.

Since 1974, the School of Forestry has selected the students who are accepted into the professional program. We feel that 40 students entering FOR 313-316 Semester – A is the maximum number that we can effectively provide quality education due to our instructional format as discussed earlier.

***B. Professional Forestry Program Admission Procedures and Application***

Appendix C provides detailed explanation of the application and selection process. This was previously discussed under the Introduction of Standard II: Curriculum.

**1) Number of Forestry graduates**

Data on the number of students graduating with a Bachelor of Science in Forestry for the period academic Year 1998 to 2002 is as follows:

Degree	AY 1998	AY 1999	AY2000	AY2001	AY2002
BS Forestry	20	25	26	35	29

One of the goals of the Forestry Program is to truly fill each entering class with the limit of 40 students. Assuming a degree award success rate of 90% we would project graduating approximately 36 students in each of the next five years.

We are sorry to report that the School currently does not have data (Document F) on the forestry record employment record for our graduates. We are in the process of gathering this data and will report on it when it has been obtained.



### **C. Undergraduate Enrollment data**

Fall Semester undergraduate enrollment data for the period 1998 to 2002 follows:

Year	# Female students	# Male students	Total Enrollment
1998	38	139	177
1999	52	129	181
2000	57	124	181
2001	52	114	166
2002	31	94	125

Forestry enrollment by ethnicity for the same period is:

Year/Sem	Asian	Black	Hispanic	International	Native American	Unknown	Caucasian	Grand Total
2002		2	5		8		110	125
2001	1	1	10		17	1	136	166
2000			3	2	15	1	160	181
1999	1		9		15	1	155	181
1998	1		11	1	16		148	177

### **D. Cultural, Ethic, and Gender Diversity**

As noted earlier under Standard IV Faculty, the School of Forestry is committed to the recruitment and retention of minority students, students who contribute to cultural diversity and/or gender diversity. We believe the data just presented reflects a record that we can be proud of. During the period 1998 to 2002 enrollment of females was on the average 21.7 percent while the average for Hispanics was 3.6 percent and 6.70 percent for Native Americans. The overall average enrollment for all minorities was 10.84 percent.

Minority recruitment and retention, especially of Native Americans and Hispanics, has long been a concern and priority of both the School of Forestry and Northern Arizona

University. Intensive counseling and advising services are available to minority students through the School's faculty, Student Services Coordinator, and Native American Forestry Program. Until the recent budget cuts, the Native American Forestry Program hired a full time student counselor for its Native students. That position is now frozen however. Other support services and mechanisms are available through NAU Student Services.

### ***E. School of Forestry Advisement and Placement Services***

All faculty of the School of Forestry advise undergraduate students. When a student enters the Forestry Program they are assigned a faculty advisor who continues as their advisor until they graduate. Students are informed, however, that they are free to switch advisors for reasons of incompatibility or if they find a career path better suited to another faculty member. The School faculty approved the *Academic Advising Policy* which can be found in Appendix J. Students are expected to meet with their faculty advisor at least once every semester. The average advising load at the present time is approximately 6 students per faculty member.

The School's Student Services Coordinator and a senior faculty member are primarily responsible for summer internships and job placement. The School maintains an up-to-date job placement board just outside the Minor Student Center on the ground floor. Announcements for summer intern positions, volunteer opportunities and permanent jobs are also sent to all undergraduate students via the School undergraduate and graduate student list serves. Students receive these notices probably on the average at least once per week. A copy of a recent email is presented in Appendix K.

The NAU Office of Career Services located on North Campus also notifies the School of Recruiting Visits by forestry-related employers.

## ***F. Student Involvement in Decision Making***

The main opportunities for student input into the policy- and decision-making processes of the School are through 1) the formal student evaluations of every course every semester and 2) the consultant facilitated evaluations done at the end of each semester of the professional forestry program. The recommendations and suggestions contributed by students through these channels are seriously considered by the Chair and the faculty, and are frequently incorporated into the curriculum partially or in their entirety.

In addition to the above formal processes, the Chair and the entire faculty and the Student Services Coordinator have an open-door policy, allowing students to express their concerns about some matter with their advisor, the Professional Semester Coordinator, or the instructor.

## ***G. Student Opportunities for Extracurricular Activities***

Forestry students have access to several opportunities for extracurricular professional participation and development within the School of Forestry. About one third of the students belong to the Student Chapter of the Society of American Foresters also called the Forestry Club. Club activities include volunteer work with natural resource agencies in the Flagstaff area such as the Forest Service, informational forestry-related meetings, field trips and outings, “get-acquainted” socials and field days and community service projects.

Students are encouraged to attend the monthly meetings of the Northern Arizona Chapter and Southwest Section meetings as well as the national meeting of the Society of American Foresters. We are pleased to be able to say that at least 6 students have attended the National SAF meeting for the last five to six years. The Student Chapter organizes a supper and program each semester for the SAF Northern Arizona Chapter as a fundraiser.

Approximately fifty percent of the students in the upper division Professional Forestry program are eligible for membership in and belong to Xi Sigma Pi, the forestry honor society. Members work on designated service projects.

NAU also recognizes approximately 200 student organizations annually. Among them are the Association of Residence Halls, Associated Students for Women's Issues, Native Americans United, Cardinal Key, Mortar Board, the Panhellenic Council, Interfraternity Council, Northern Lights, and many others. Student organizations are organized according to academic, advocacy, cultural, religious, service, special interest, and sports and recreational interest as well as fraternities and sororities.

#### ***H. Campus Opportunities for cultural and intellectual stimulation***

Forestry students are active members of the campus community and belong to fraternities, sororities, other honoraries, and service organizations. They also participate in intramural athletics, bands, orchestras, and chorales. No formal survey have been conducted on the degree of their involvement in cultural, intellectual, and social activities, but observations by faculty would indicate that the level of participation of forestry students in campus activities is below the student body as a whole. This may result from the immersion format beginning at the start of the upper division Professional Forestry program. We also attribute this to changing student demographics that include more older and married students.

Due to the instructional agenda of constant contact and interaction among students in the four professional semesters, a lifelong fraternal bond often develops among class members. This "esprit de corps" is not generally obvious among other Schools and Colleges at NAU.

## ***I. Knowledge Integration and Competence Assessment***

We believe part of this area has already been addressed in some detail under Standard II. Curriculum Part III The Professional Forestry Program Sections G – I Subject Area Outcomes, Activities and Assessment and Section L. Learning Assessment.

Requiring students to satisfactorily complete required basic coursework in the biological and social sciences and in quantitative and communications skills prior to acceptance into the upper-division Professional Forestry Program provides a commonality in the background education that the School believes is essential to an adequate preparation for the professional forestry degree.

The four semester integrated program is designed to continually expand the student's knowledge of resource management principles. The first semester, FOR 313-316 (Forest Science – A), is heavily oriented toward fieldwork and introduces the students to the biophysical aspects of forestry through detailed study of forest and range ecology, surveying and forest measurements, dendrology and plant identification, silvics and silviculture, wood properties, fire and pest management, and similar essential basics.

FOR 323-326 (Forest Science – B) continues to build on the principles and techniques presented in Semester A. This semester emphasizes multiresource management through exposure to economics and management principles for timber, range, recreation, wildlife, and watershed resources. Decision theory is developed, and decision-making skills are addressed through computer simulation directed toward illustrating the interrelationships and complexities of the resources.

FOR 413-414 and FOR 423-424 (Forest Science – C and D) are the capstone experience of the Professional Forestry Program and are designed to incorporate and expand on the knowledge acquired in all previous coursework. The students are presented with the objectives, parameters, and guidelines of a realistic multiresource management situation.

They are then required to individually formulate and present in a professional manner a management analysis for each resource, including justified recommendations.

Working as small crews, the students survey, inventory, and assess the quality and condition of the various resources on a designated unit. The students then pool, compile, and analyze the data. Under the guidelines of the project and the direction of the faculty, each student then prepares his/her management analysis, considering the impact of management practices on each resource and the implications of those practices on the other resources. Computer simulation is employed by each student to determine the feasibility of various alternatives.

The capstone experience also addresses the transition from an academic to a professional environment. In semester A, and slightly less in semester B, grades are directly related to points on assignments. While this structure for evaluation helps students succeed, it also allows them to strategize, and sometimes to focus too much on obtaining points. The capstone semester eliminates points, and assigns percentages to major projects, analogous to work load percentage in the professional workplace. This change in evaluation and increased time management responsibilities (i.e. fewer deadlines, larger projects) facilitates student development of skills needed in the workplace. This transition is explicitly included in the curriculum, and faculty “bosses” meet weekly with students to mentor and evaluate progress.

Throughout the four semesters, there are examinations at the conclusion of each instructional component to assess the student’s understanding of the area of knowledge. Reports and papers are also required. The management analysis prepared for Semester C and D provides a comprehensive evaluation of the student’s understanding of the principles, techniques, and theories presented during the three professional semesters. It also measures the individual’s ability to communicate with other professionals and with the public.

## **Standard VI. Parent Institute Support**

### ***A. Institutional Strengths and Supporting Departments***

Clearly the greatest strength the School of Forestry has at Northern Arizona University is the long-standing support from the administration. NAU's upper administration has supported the School since it began as a department in 1958. The long history of forestry in Northern Arizona and being the *Lumberjack* campus clearly have help the School. The School likes to think that in turn, Forestry had been one and continues to be one of NAU's premier and most productive innovative programs.

There are several other highly significant general factors we would like to point out. Paramount among these is the continued overall campus' commitment to undergraduate education with the concomitant focus on teaching. To this we would add the relatively small size of the institution, which permits ready access to other faculty, every faculty member, department and administrative level. To this we would add location. For students interested in any aspect of the environment, Flagstaff and its environs, with Merriam's life zones and Zane Grey's adventures, seems an ideal place to study and play.

The Department of Biology continues to be highly productive, and favored with strong and able leadership. Certainly at the undergraduate "service course" level but particularly at the graduate level, the Biology Department has provided the School of Forestry with excellent support in both educational and research services and collaboration.

While it exact role is still evolving, the recently created Center for Sustainable Environments is also an asset. It has clearly raised the visibility and importance of environmental issues concerns and education across the campus. Over the last several years there has been considerable talk on the campus about NAU's becoming a leading "environmental institute".

Lastly we would point to the recently approved Ecological Restoration Institute (ERI) directed by Forestry faculty member and Regents' Professor W. Wallace Covington. Formally approved by the Arizona Board of Regents' in 1998, the ERI has strengthened the School in a number of different ways including:

- a. NAU receives approximately \$250,000 annually to support an undergraduate research experience in ecological restoration. Forestry students make up the largest population participating each semester.
- b. Funding from the ERI has permitted NAU to add additional faculty and staff with an interest in and orientation to forestry. Assistant Professor Pete Fulé being the prime example (c.f. Document C and D).
- c. Thanks to the sizable extramural fund the ERI has brought to NAU the President's Office provided funding for an approximately \$800,000 addition to the ground floor of the Southwest Forest Science Complex. This included a much-needed CESM GIS undergraduate teaching laboratory.

The School of Forestry, generally speaking, is satisfied with the breath and accessibility of supporting programs. The "service courses" are less freely accessible than they have been in the past; require greater care in advising and scheduling. The major institutional weakness lies in the fact that NAU is not a Land-Grant institution. As a consequence there is less depth than one would ideally like in such areas as entomology, pathology, statistics, hydrology etc. This has become even more evident with the advent of the PhD program and undergraduate emphasis areas.

### ***B. Institutional Financial Support***

The School's annual budget for the period 1999-2003 is presented in Table 12. In Table 13 we compare the School's 2003 teaching budget to that various other academic departments.



**Table 12. The School of Forestry budget breakdown for the years 1999-2003**

<b>Forestry Budgets - 5 years</b>					
<u>Forestry</u>	<u>2003</u>	<u>2002</u>	<u>2001</u>	<u>2000</u>	<u>1999</u>
Salaries	1,715,789	1,598,851	1,691,977	1,715,936	1,660,578
Student Wage	1,799	1,799	15,000	15,000	25,729
Operations	39,600	37,800	55,400	50,000	45,600
Out-side Services	1,800	1,800	2,250	2,250	2,250
Travel In-state	15,300	15,300	18,000	18,000	18,000
Travel Out-of-state		3,600	7,280	7,280	14,000
Capital			15,000	15,000	20,000
<b>Total Educational Budget</b>	<b>1,774,288</b>	<b>1,659,150</b>	<b>1,804,907</b>	<b>1,823,466</b>	<b>1,786,157</b>
<u>BFR 1194</u>	<u>2003</u>	<u>2002</u>	<u>2001</u>	<u>2000</u>	<u>1999</u>
Salaries	127,384	124,847	153,510	151,422	143,080
Student Wage	9,801	9,801	9,801	9,801	9,801
Operations	37,971	35,100	35,100	35,000	35,000
Out-side Services	8,500	8,500	8,500	8,500	8,500
Travel In-state	5,000	5,000	5,000	5,000	5,000
Travel Out-of-state		5,742	5,742	5,742	11,000
Capital	35,400	35,400	35,400	35,400	35,400
<b>Total</b>	<b>224,056</b>	<b>224,390</b>	<b>253,053</b>	<b>250,865</b>	<b>247,781</b>
<u>McIntire-Stennis</u>	153,914	153,914	147,466	148,245	154,936
<b>Total Research Budget</b>	<b>377,970</b>	<b>378,304</b>	<b>400,519</b>	<b>399,110</b>	<b>402,717</b>
(BFR 1194 & McIntire-Stennis)					

**Table 13. The School of Forestry budget in comparison to other academic units**

<b>2003 Budget Comparison</b>						
	Forestry	Biology	Anthropology	Geology	Chemistry	English
Salaries	1,715,789	2,186,756	980,547	1,110,506	1,010,709	2,284,147
Student Wage	1,799	53,395	9,500	9,516	35,982	10,415
Operations	39,600	96,600	16,731	47,000	62,600	30,000
Out-side Services	1,800	2,500	500	2,000	1,000	3,000
Travel In-state	15,300	1,000	3,900	4,000	1,000	2,000
Travel Out-of-state						
Capital						
Total	1,774,288	2,340,251	1,011,178	1,173,022	1,111,291	2,329,562
FTE	32.11	40.90	16.50	18.72	19.00	37.92
	55,257	57,219	61,284	69,728	53,195	60,235

**Table 14. The School of Forestry average salaries plus comparisons**

<b>Average salary for 2003</b>			
	Forestry	Biology	Geology
Professor	65,350	66,738	69,835
Assoc. Professor	49,531	51,274	53,825
Asst. Professor	43,752	44,223	50,000

### ***C. Adequacy in Institutional Student Support***

Northern Arizona University offers its student all the normal student support and services needed to fully serve its students. This includes among others:

- The Fronske Health Center
- Health Psychology Center
- Counseling and Testing Center
- Disability Support Services
- Career Services

These services when coupled with the School's strong commitment to assisting its students along their career path are deemed more than adequate.

### ***D. Funds for Faculty Development and Travel***

Despite the recent budget reductions, we believe the School is able to provide the funds needed by faculty for both development and travel. Faculty who seek funding for these purposes apply directly to the Chair. Highest priority is given to untenured faculty. Most tenured faculty have active research programs that they use themselves for travel etc. Additional funding for these purposes comes from generated overhead and summer school funds (summer attainment) returned to the College, a portion of which is returned to the School.

### ***E. Adequacy of library facilities***

NAU has but one library facility – the Cline Library located on North Campus. The library has more than two million items in its collections, including books periodicals, government publications, microforms, videos, sound recordings and archival materials

related to the Colorado Plateau and Northern Arizona University. The library also licenses more the 120 databases, searchable via their website.

The library has more than a hundred computer workstations throughout the library providing access to the World Wide Web and to the campus network. Students can connect laptops to the NAU network from within the library. The Media Services Departments provides assistive technology for library uses with special needs.

While not outstanding, the forestry holdings are clearly adequate.

### ***F. Faculty Salaries***

Average school of Forestry Faculty salaries for all three tenure track ranks are presented in Table 14. For comparative purposes average salaries for the Departments' of Biology and Geology have been added.

### ***G. Computer Services and independent study facilities***

#### **1) Computing Environment within the SW Forest Science Complex**

The College maintains approximately 225 personal computers allocated roughly as follows: 60 faculty computers, 40 staff computers, 60 computers in three student labs, 60 computers in research labs, and 7 computers for classroom multimedia. With very few exceptions, the computers are configured under Windows 2000 or Windows XP, running a full compliment of web browser, email, antivirus, and utility software as well as the Microsoft Office Suite. Additional software packages available in the three PC labs include the Corel Office Suite, Adobe products, GIS/remote sensing software such as ArcGIS and Imagine, statistical analysis software such as SAS JMP and SPSS, and forest modeling software such as Forest Vegetation Simulator. One of the PC labs is open to graduate students 24 hours per day, 7 days per week; the other two PC labs are open to all students during the week through the evening hours and six hours each on Saturday and Sunday.

A four-year replacement plan for computers and a six-year replacement plan for printers are in place for faculty and permanent fulltime state supported staff. Budgetary circumstances, however, have permitted replacement of computers for all these faculty and staff during the past three years. Machines are replaced using a “base-configuration” model. For example, the base-configuration for machines replaced in fiscal year 2002/2003 was a Dell Optiplex GX240 with 512 Mbytes RAM, 40 GByte Hard Disk Drive, CDRW, and 15 inch flat-screen monitor.

The College maintains its own Windows NT domain served by a Dell PowerEdge 2650 Server, a Dell PowerEdge 2300 server, a Dell PowerEdge 1650 print and application server, a Dell PowerVault 220S hardware RAID disk array supporting over 750 GBytes of file storage capacity, and a Dell PowerVault 122T LTO tape backup system. In addition, the college maintains a Linux server for specialized web service, email support, and on-line course evaluations.

Most faculty and staff members have a black and white laser or color inkjet printer connected directly to their computer. Additionally the college supports eight network accessible high volume printers (two color laser, two color inkjet, and four black and white laser printers) as well as a Hewlett Packard Design Jet 800PS color plotter capable of handling 42 inch roll-stock paper.

Other peripheral devices supported in the College include several desktop scanners, a photographic slide scanner, a photographic film recorder, numerous tablet digitizers, and one 36x48 inch digitizing tablet.

The above IT infrastructure is supported by the School’s IT Support Team which is comprised of two full-time IT professionals. In addition, an IT Help Desk is staffed during the standard 40-hour work week by three part-time student workers. The School’s IT Support Team is available to faculty, staff, and students for assistance and consulting services during normal business hours.

## 2) Campus-wide Computing Environment

In addition to the computing environment within the College, faculty, staff, and students have access to four campus computing labs and are issued campus-supported UNIX accounts for email processing and file storage. The labs are open seven days per week with hours extending throughout the day and evening.

Assistance and consulting services for PCs and software applications are available through the university computing center. The Student Help Desk is available to students 24 hours per day, 7 days per week and is staffed by four full-time IT professionals and six part-time student workers. The Solution Center is available to faculty and staff during normal business hours and is staffed by seven full-time IT professionals. Additionally, the campus provides in-class training and on-line training for faculty and staff in a wide range of software applications and computing hardware maintenance and use.

The campus supports web servers for individual faculty, staff, and student use. Depending upon personal preference or application needs, individuals may establish web sites on Apache servers running under UNIX or on IIS servers running under Windows. Additionally the campus provides IIS web service under Windows for the School's web site ([www.for.nau.edu](http://www.for.nau.edu)).

The School, the College, and the Campus are committed to maintaining state of the art computing hardware and software resources for all faculty, staff, and students.

## Standard VII: Physical Resources and Facilities

### ***A. Building space and facilities***

#### **1) Forestry Space**

Space within the Southwest Forest Science Complex that is assigned to the School of Forestry is listed below.

**Teaching** (all teaching space is shared with the other two academic units in the College of Ecosystem Science and Management (CESM)).

<b>Rooms</b>	<b>Number of Rooms</b>	<b>Square Footage</b>	<b>Total (sf)</b>
<b>Auditorium</b>	1	1,988	1,988
<b>Lecture Hall</b>	1	862	862
<b>Seminar Room</b>	1	446	446
<b>Classrooms</b>	3	2,680	2,680
<b>Total Teaching Area</b>			5,976
<b>Computer Labs</b>	3	2,674	2,674
<b>Server/Storage</b>	2	233	233
<b>Information Technology</b>	3	390	390
<b>Student Space</b>	2	677	677
<b>Conference Room</b>	2	536	536
<b>Emeritus Faculty Room</b>	1	144	144
<b>Faculty Offices</b>	19	152 average	2,900
<b>Faculty Research Labs</b>	12	720 average	8,644
<b>Graduate Student Offices</b>	5	351 average	1,758
<b>Centennial Forest Offices</b>	2	143 average	286
<b>Research Offices</b>	4	290 average	1,163
<b>Administrative Offices</b>	2	279 average	558

## ***B. Other facilities***

In April 2000, Governor Hull signed an intergovernmental agreement creating the Centennial Forest to serve as a nationally recognized forest and model for the entire United States. The 75-year agreement between the Arizona State Land Department and Northern Arizona University specifies education, forest health, maintenance of natural forest assets and values, reduction of the risk of wildfire, and long term ecological research as stewardship objectives for this diverse 47,000 acres of land.

The Centennial Forest will be a mainstay in Forestry education at NAU. In AY 2001-2002 the senior capstone course used the Forest as its land base for the multi-resource inventory exercises.

## ***C. Adequacy of Physical Resources***

The Centennial Forest serves as the primary outdoor laboratory for the professional forestry program at Northern Arizona University. Nearly all Forestry field classes, or modules of team-taught field classes are taught on the Forest.

Typically, a Forestry student's field course work begins with Forestry 211 (Forest Measurements and Mapping). Permanent plots, orienteering courses, distance measurement courses, and the like are established on the Forest for these students to learn the basics of tree measurements and forest mapping. Last year FOR211 students spent over 28 hours in the field. During Semester A, plant identification labs as well as wildlife and recreation modules are taught on the Forest. The senior capstone experience (Semesters C and D) involves approximately 120 hours of field work. In semester C, students collect data on the current conditions of vegetation characteristics, roads, fuel loads, recreation attributes, and timber volume on a several thousand acre management unit. In Semester D students analyze these data and develop a management plan for the unit. This work completed by forestry students provides the primary data used for actual management projects on the Centennial Forest.



In 2002 over 3,200 student-hours were spent on the Centennial Forest. Anthropology, Biology, Parks and Recreation Management, and other courses accounted for an additional 3,000 student-hours of Centennial Forest field-based education.

## **Standard VIII. Research, Extension, Continuing Education, and Public Service**

### ***A. Research as related to the under graduation education program***

The School of Forestry has an active research program. In Academic Year 2001/2002, the School had \$ 623,549 in new extramural funds from 21 new research projects.

In general, our Forestry faculty, through the annual evaluation process, are expected to demonstrate how their research activities are used in, and useful for, classroom instruction. Several research projects by individual faculty have resulted in text materials for both the undergraduate and graduate programs.

We also believe that via their research projects the faculty stay up to date with developments in forestry and which are pertinent to the classroom. Having an active research program also assists the School in attracting and retaining high quality individuals.

NAU does not have a formal extension or continuing education role as the University of Arizona in Tucson (the other lesser known forestry program in the state sic) is the Land Grant Institution. We do, however, provide some continuing education through occasional workshops and short courses.

The School conducts a regular Forestry seminar program in which invited speakers address a host of topical and timely issues. Through publicity to the University, the forestry community, and the general public the program is made available at no charge. Annually the School sponsors the William P. Thompson Memorial Lecture, wherein

nationally recognized natural resource experts come to campus to deliver a significant lecture on forestry- related issue. The lecture is normally presented during the University Honors Week and this too is open to the public.